

PATENT ABSTRACTS OF JAPAN

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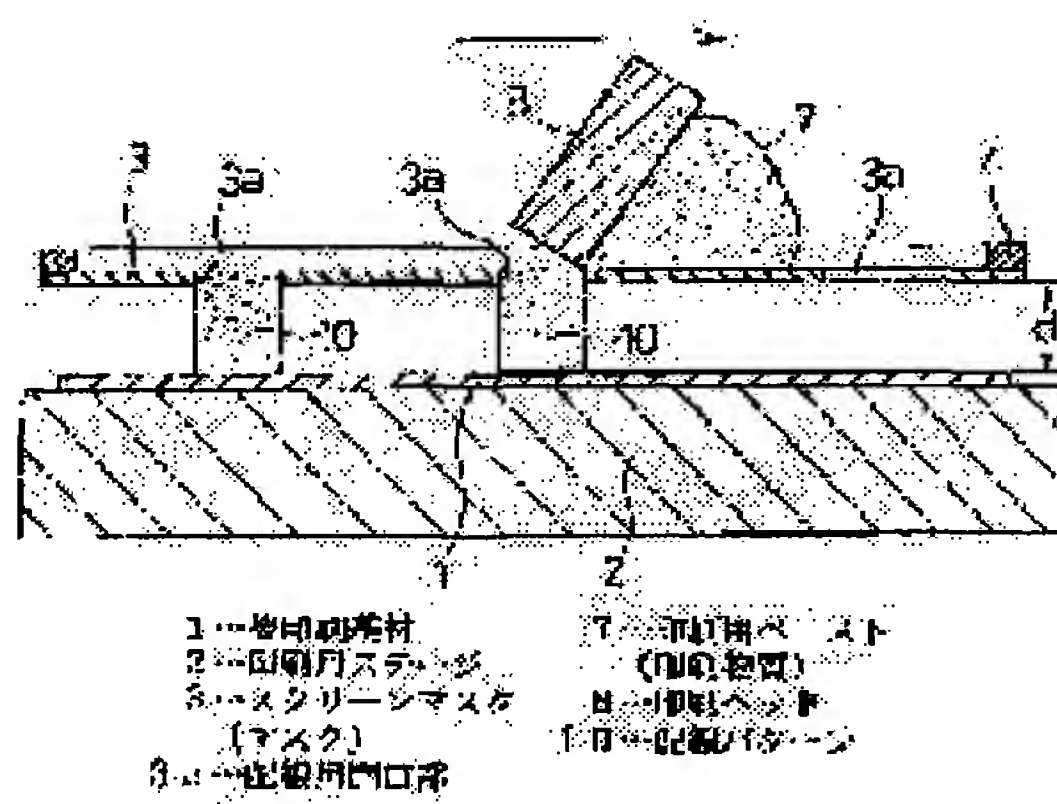
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(54) METHOD AND APPARATUS FOR PRINTING PRINTED CIRCUIT BOARD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method and an apparatus for printing a printed circuit board capable of forming a wiring pattern having an arbitrarily set large thickness and a connecting land on a base to be printed without introducing an increase in a manufacturing cost or a fault as the wiring pattern.

SOLUTION: The method for printing the printed circuit board comprises the step of disposing a mask 3 having openings 3a for wirings to form a wiring pattern 10 oppositely at a predetermined interval (d) parallel to the base 1 to be printed. The method further comprises the steps of passing a printing substance 7 carried on the mask 3 through the openings 3 while moving the substance 7 by a print head 8 to adhere the substance onto the base 1 to print and form a predetermined wiring pattern 10 with the substance 7 adhered onto the base 1. When the substance 7 is moved by the head 8, the mask 3 is held so as not to be contacted with the base 1.



CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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CLAIMS

[Claim(s)]

[Claim 1]It arranges so that for [of the mask which has an opening for wiring for forming a circuit pattern] relativity may be carried out at the parallel and predetermined intervals to a printing substrate, By passing said opening for wiring and making it adhere on said printing substrate, moving quality of printed matter put on said mask by the print head, A printing method of a printed circuit board holding said mask so that said printing substrate may not be contacted when carrying out print formation of the predetermined circuit pattern by said quality of printed matter which adhered on said printing substrate and moving said quality of printed matter by said print head.

[Claim 2]A printing method of the printed circuit board according to claim 1 which gave thrust within limits by which said mask is not bent to said print head while fixing to a relative position which has a predetermined gap to a printing substrate at the time of movement of quality of printed matter according a mask to the print head.

[Claim 3]A printing method of the printed circuit board according to claim 1 or 2 to which it was made to move said quality of printed matter while making a part of quality of printed matter the print head remain on a mask.

[Claim 4]An angle [as opposed to said mask of said print head for quantity of quality of printed matter which remains on a mask after the print head passes], A printing method of the printed circuit board according to claim 3 set up by controlling at least one of the movement speed of thrust to said mask of said print head, and said print head.

[Claim 5]A stage for printing to which a printing substrate for forming a circuit pattern is set, Mask support supported by arrangement which carries out for [of the mask which has an opening for wiring for forming a circuit pattern] relativity at the predetermined intervals to said printing substrate, The print head which passes said opening for wiring and is made to adhere on said printing substrate moving quality of printed matter put on said mask to a print direction, A head attachment component which supports said print head enabling free up-and-down motion, and a head transfer mechanism which moves said head attachment component to a print direction, A printer of a printed circuit board which having a control section which controls thrust to said mask of said print head by adjustment of a lower limit position of said head attachment component, and constituting.

[Claim 6]Mask support consists of two or more spacers for support which have predetermined thickness and intervene between a stage for printing, and a mask, and said each spacer for support, A printer of the printed circuit board according to claim 5 currently installed on said stage for printing by arrangement which can support both ends of the print head which can be laid in the state where said mask builds between each upper surfaces and, where it moves via said mask.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the method and printer which print a circuit pattern to a printing substrate when manufacturing the printed circuit board which mounts electronic parts in a necessary place and is used for the circuitry of electronic equipment.

[0002]

[Description of the Prior Art]In recent years, the densification of a circuit pattern and high integration are demanded of the printed circuit board with miniaturization of electronic equipment.

It is small, and in order to realize highly efficient-ization, multilayering is further promoted from one side wiring by double-side wiring.

Generally this printed circuit board thermosetting resin Paper, synthetic fiber cloth, To the printing substrate which consists of a laminate sheet produced by carrying out press working of sheet metal after accumulating the thing with which it was spreading-impregnated and, which substrates, such as a woven glass fabric and a nonwoven glass fabric, were made to dry. Mainly by the presswork using the print heads, such as a squeegee, a circuit pattern and the beer hall for interlayer connections are formed, and it is manufactured. In presswork, since very much conditioning, such as hardness of the print head, an angle of gradient, printing pressure, and movement speed, occurs and the difference of slight conditioning affects quality, conditioning is adjusted based on experience in a manufacture site, and improvement in the process yield is aimed at.

[0003]It explains referring to for the general printing method of the circuit pattern in the manufacturing process of the conventional printed circuit board the sectional view of drawing 7 in which the presswork was shown typically next. The printing substrate 1 is set on the stage 2 for printing, few gaps are consisted above the printing substrate 1, and the screen mask 3 is arranged. The screen mask 3 is stuck on the screen frame 4, and the paste 7 for printing is supplied on the screen mask 3. For example, the print head 8 which consists of squeegees is made to adhere on the printing substrate 1 through the opening 3a for wiring for forming the circuit pattern of the screen mask 3 in the state of plastering the screen mask 3 with the paste 7 for printing. This print head 8 is formed in the print direction shown by the sliding direction and a graphic display arrow movable, respectively.

[0004]In the above-mentioned presswork, while the printing substrate 1 is set to the prescribed position on the stage 2 for printing, It positions so that for [of the printing substrate 1 which the paste 7 for printing is supplied on the screen mask 3, then the stage 2 for printing moves, and is set to this] relativity may be carried out by parallel arrangement in the lower part of this to the screen mask 3. After it, the screen mask 3 descends and is positioned by the predetermined interval to the printing substrate 1.

[0005]Next, the screen mask 3 is caudad depressed by the print head 8 which descended, and is lightly contacted by the printing substrate 1 by it. The print head 8 is swept in the print direction, with the above-mentioned height position held. Thereby, the paste 7 for printing on the screen mask 3 is moved while the screen mask 3 is plastered by the print head 8, and the

screen mask 3 which has elasticity returns to the original position from the printing substrate 1 by own stability, immediately after the print head 8 passes. Then, it adheres to the paste 7 for printing on the printing substrate 1 from the opening 3a for wiring of the screen mask 3, and print formation of the circuit pattern is carried out on the printing substrate 1.

[0006]

[Problem(s) to be Solved by the Invention]However, in the above-mentioned presswork, the screen mask 3 is pushed against the printing substrate 1 by the thrust of the print head 8, Since print formation of the circuit pattern 9 is carried out by making the paste 7 for printing adhere on the printing substrate 1 through the opening 3a for wiring of the screen mask 3, the thickness of the circuit pattern 9 becomes only a slightly larger grade than the thickness of the screen mask 3 inevitably. On the other hand, since the pore shape of the opening 3a for wiring of the screen mask 3 for forming this becomes very small for example, in forming the minute land for connection corresponding to the miniaturization of electronic parts, it becomes difficult to supply the paste 7 for printing smoothly on the printing substrate 1. As a result, in the paste 7 for printing with which the opening 3a for wiring of very small pore shape was filled up, the part remains in the opening 3a for wiring, Since the minute land for connection printed with the paste 7 for printing of this quantity that ran short has insufficient thickness or a chip arises in shape, faults, such as omission etc. of the electronic parts mounted in this land for connection, are caused, and the yield of the electronic packaging circuit board falls.

[0007]On the other hand, although high density is demanded with miniaturization of electronic equipment in recent years, the circuit pattern needs to make width of wiring small, in order to attain the densification. However, in the conventional presswork, since it is difficult to form the wiring which has big thickness as mentioned above, when width of wiring is made small under such a situation, the new problem that the current capacity determined by the width and thickness of wiring will become small occurs. Therefore, in the conventional presswork, since thickness of wiring cannot be enlarged, width of wiring cannot be made small, either but this has become a factor which checks the densification of a circuit pattern.

[0008]Then, in order to cancel above-mentioned fault, by enlarging thickness of the screen mask 3, capacity in the opening 3a for wiring is also enlarged, and can consider giving big wiring of thickness. However, when it is made such, to formation of the comparatively large-sized land for connection for electronic parts, it is convenient, but. In forming a detailed circuit pattern and the minute land for connection, The opening 3a for wiring for forming the circuit pattern serves as slender sectional shape in connection with the thickness of the screen mask 3 becoming large in the thickness direction of the screen mask 3, and the smooth supply to the printing substrate 1 of the paste 7 for printing becomes difficult. That is, in the screen mask 3 with big thickness, neither a detailed circuit pattern nor the minute land for connection can be formed.

[0009]The screen mask 3 with comparatively big thickness which has the opening 3a for wiring for on the other hand forming the land for connection of only large-sized electronic parts, Preparing two kinds of the screen masks 3 with comparatively small thickness which have the opening 3a for wiring for forming a detailed circuit pattern and the minute land for connection is also considered. However, since the number and presswork of the screen mask 3 increase when [both] it is made such, increase of a manufacturing cost is caused.

[0010]In the former, the above-mentioned presswork is preceded as one of the measures against the above faults, In the part which should form a circuit pattern with the screen mask 3 in the printing substrate 1. After performing plating processing and supplying a constant rate of pastes 7 for printing beforehand, Use the screen mask 3 for the adhesion part of the paste for printing, and supply the paste 7 for printing of an insufficiency, or, Conversely, after using the screen mask 3 for the printing substrate 1 and printing the circuit pattern 9 by the paste 7 for printing, on the circuit pattern, the paste for printing of an insufficiency is supplied and it corresponds. However, in such a means, the presswork of the paste 7 for printing increases and a manufacturing cost costs dearly.

[0011]Then, the circuit pattern and the land for connection for which it has the big thickness which this invention was made in view of the above-mentioned conventional technical problem,

and was set up arbitrarily, It aims at providing the printing method and printer of a printed circuit board which can be formed on a printing substrate without causing increase of a manufacturing cost, and generating of the fault as a circuit pattern.

[0012]

[Means for Solving the Problem]To achieve the above objects, a printing method of a printed circuit board of this invention, It arranges so that for [of the mask which has an opening for wiring for forming a circuit pattern] relatively may be carried out at the parallel and predetermined intervals to a printing substrate, By passing said opening for wiring and making it adhere on said printing substrate, moving quality of printed matter put on said mask by the print head, When carrying out print formation of the predetermined circuit pattern by said quality of printed matter which adhered on said printing substrate and moving said quality of printed matter by said print head, it is characterized by holding said mask so that said printing substrate may not be contacted.

[0013]In a printing method of this printed circuit board, since quality of printed matter is made to adhere to a printing substrate, without contacting a mask to a printing substrate, thickness of a circuit pattern by which print formation is carried out on a printing substrate is mostly in agreement with an interval of a printing substrate and a mask regardless of thickness of a mask. Therefore, thickness of a circuit pattern can be set as any value by changing a mask into arbitrary intervals to a printing substrate. Since thickness of a circuit pattern can be set up regardless of thickness of a mask, thickness of a mask can be made thin as much as possible. In this printing method, these enable it to carry out print formation to specified shape which has necessary thickness and does not have a chip etc. certainly, even if it is a detailed circuit pattern and a minute land for connection. And since a circuit pattern can be formed by 1 time of presswork using the same mask, increase of a manufacturing cost is not caused.

[0014]In the above-mentioned invention, while fixing to a relative position which has a predetermined gap to a printing substrate at the time of movement of quality of printed matter according a mask to the print head, it is preferred to give thrust within limits by which said mask is not bent to said print head.

[0015]Thereby, since an interval of a mask and a printing substrate is certainly held over the whole at constant value also at the time of movement of quality of printed matter by the print head, it can be formed in thickness which set up a circuit pattern certainly over the whole.

[0016]In the above-mentioned invention, it is preferred to move said quality of printed matter, making a part of quality of printed matter the print head remain on a mask. By this, when pulling up a mask after an end of printing, shearing stress acts on a part adjacent to an open end porous wall side of an opening for printing of a mask in a printed circuit pattern intensively, but. Adhesive power of a circuit pattern in this stress concentration part declines by existence of quality of printed matter which remains on a mask, and adhesion force to an open end porous wall side of an opening for printing of a circuit pattern of a stress concentration part also declines in connection with it. Therefore, to a circuit pattern in a stress concentration part. since shearing force at the time of pulling up a mask is markedly alike, is reduced and a piece does not arise, only in a part in which quantity of quality of printed matter which a dent etc. do not produce a printed circuit pattern in the upper bed side, and also remains in an opening for printing of a mask decreases, thickness becomes large.

[0017]Quantity of quality of printed matter which remains on a mask in the above-mentioned invention after the print head passes, It can set up by controlling at least one of the movement speed of an angle to said mask of said print head, thrust to said mask of said print head, and said print head. . [whether this arranges the print head so that an angle to a mask may become small, and it is made to incline greatly towards the move direction, and] If which means is adopted even if there are whether a pressure to a mask of the print head is set up small a little or movement speed of the print head is set [little] up late slightly, Since power which scratches quality of printed matter on a mask by the print head declines, a little quality of printed matter can be made to remain on a mask after the print head passes.

[0018]On the other hand, a printer of a printed circuit board of this invention, A stage for

printing to which a printing substrate for forming a circuit pattern is set, Mask support supported by arrangement which carries out for [of the mask which has an opening for wiring for forming a circuit pattern] relatively at the predetermined intervals to said printing substrate, The print head which passes said opening for wiring and is made to adhere on said printing substrate moving quality of printed matter put on said mask to a print direction, A head attachment component which supports said print head enabling free up-and-down motion, and a head transfer mechanism which moves said head attachment component to a print direction, It is characterized by having a control section which controls thrust to said mask of said print head by adjustment of a lower limit position of said head attachment component, and being constituted.

[0019]In a printer of this printed circuit board, since it has mask support which supports a mask at a predetermined interval to a printing substrate, and a control section which controls thrust to a mask of the print head, a printing method of this invention can be embodied faithfully and an effect of a printing method can be acquired certainly.

[0020]Mask support consists of two or more spacers for support which have predetermined thickness and intervene between a stage for printing, and a mask in the above-mentioned invention, and said each spacer for support, It is preferred to have composition currently installed on said stage for printing by arrangement which can support both ends of the print head which can be laid in the state where said mask builds between each upper surfaces and, where it moves via said mask.

[0021]Since it moves by this while a both-ends portion of the print head is supported with two or more spacers for support via a mask, thickness, an interval, i.e., a circuit pattern, to a printing substrate of a mask, Since it can set up by choosing and installing a spacer for support which has desired thickness, it can always hold certainly to a predetermined value, without needing a complicated control circuit etc.

[0022]

[Embodiment of the Invention]It explains in detail, referring to drawings for the desirable embodiment of this invention hereafter. Drawing 1 is an outline sectional view showing typically the presswork which embodied the printing method of the printed circuit board concerning a 1st embodiment of this invention, in the figure, gives the same numerals to a thing the same as that of drawing 7, or equivalent, and omits the overlapping explanation. Although presswork concerning this embodiment is performed using the same composition as the presswork of drawing 7, That it is different from the presswork of drawing 7 is only a point which makes the paste 7 for printing adhere on the screen mask 3, and forms a circuit pattern, making only the interval d which set up the screen mask 3 arbitrarily to the printing substrate 1 estrange, and always holding the above-mentioned interval d also in the case of movement of the print head 8.

[0023]By drawing 2's being an outline sectional view showing typically the state under print operation in the above-mentioned presswork, and plastering the screen mask 3 with the paste 7 for printing by movement of the print head 8, The paste 7 for printing which passed the opening 3a for wiring for forming the circuit pattern of the screen mask 3 adheres to the printing substrate 1, and print formation of the circuit pattern 10 by the paste 7 for printing is carried out to the printing substrate 1. At this time, the print head 8 is set as the pressure which does not sag the screen mask 3, and the screen mask 3 continues holding the relative position which maintains the interval d always set up to the printing substrate 1 at the time of the print operation by movement of the print head 8.

[0024]Therefore, the thickness of the circuit pattern 10 by which print formation is carried out on the printing substrate 1 is mostly in agreement with the interval d of the printing substrate 1 and the screen mask 3 regardless of the thickness of the screen mask 3. For example, when the thickness of the screen mask 3 is 0.1 mm and the interval d of the printing substrate 1 and the screen mask 3 is 0.5 mm. The circuit pattern 10 will be formed in the thickness of 0.5 mm, and this thickness will be about 5 times as compared with the thickness (about 0.1 mm which was in agreement with the thickness of the screen mask 3) of the circuit pattern 9 formed of the

conventional presswork.

[0025]Variable setting out of the thickness of the circuit pattern 10 can be arbitrarily carried out changing the screen mask 3 into the arbitrary intervals d to the printing substrate 1, and fixing, and by controlling the pressure to the screen mask 3 of the print head 8. Since the thickness of the circuit pattern 10 can be set up regardless of the thickness of the screen mask 3, thickness of the screen mask 3 can be made thin as much as possible. Thereby, in the above-mentioned presswork, even if it is a detailed circuit pattern and a minute land for connection, it becomes possible to carry out print formation to the specified shape which has necessary thickness and does not have a chip etc. certainly.

[0026]And in the above-mentioned presswork, since only the part to which the width of wiring becomes small in connection with it can set up the thickness of wiring greatly when attaining minuteness making of the circuit pattern 10, the detailed circuit pattern 10 which has necessary current capacity can be obtained. By performing 1 time of presswork using the single screen mask 3 with small thickness in the above-mentioned presswork, since the thickness of the circuit pattern 10 can be arbitrarily set up regardless of the thickness of the screen mask 3, Since the print formation of each connecting land a detailed circuit pattern, for large-sized electronic parts, and for miniature electronic components can be carried out simultaneously, increase of a manufacturing cost is not caused.

[0027]Drawing 3 is an outline sectional view showing typically the presswork which embodied the printing method of the printed circuit board concerning a 2nd embodiment of this invention, in the figure, gives the same numerals to a thing the same as that of drawing 1, or equivalent, and omits the overlapping explanation. While the same composition is used for the presswork of this embodiment as compared with the presswork of drawing 1, Although it is the same in the point which prints by moving the print head 8 by making the paste 7 for printing adhere on the printing substrate 1, making only the interval d which set up the screen mask 3 arbitrarily to the printing substrate 1 estrange, and always holding this interval d, Only in the point which prints by moving the paste 7 for printing with remnants in small quantities on the screen mask 3 in the screen mask 3 top, the print head 8 is different. A little residual pastes 7a which remain on the screen mask 3 after the print head 8 passes, When pulling up the screen mask 3 above the printing substrate 1 after the end of printing, the mold-release characteristic over the screen mask 3 of the paste 10 for printing, i.e., a circuit pattern, printed to the printing substrate 1 is raised.

[0028]While making the print head 8 incline greatly in the presswork of this embodiment towards the move direction which is arranged so that the angle to the screen mask 3 may become small, and is shown by a graphic display arrow as compared with the presswork of a 1st embodiment, The pressure to the screen mask 3 was set up small a little, and movement speed is set up late slightly. Thereby, since the power which scratches the paste 7 for printing on the screen mask 3 declines, the print head 8 can move in the screen mask 3 top, producing the residual paste 7a. The thickness of this residual paste 7a can carry out adjustable setting arbitrarily by setting out or control of an angle, and a pressure and movement speed to the screen mask 3 of the above-mentioned print head 8.

[0029]Below, the effect by existence of the residual paste 7a is explained. In pulling up the screen mask 3 after the end of printing, the power into which the printed circuit pattern 10 is changed with the adhesive power to the screen mask 3 of the paste 7 for printing acts, but modification of the circuit pattern 10 begins from the portion which shearing stress concentrates. Drawing 4 is an explanatory view of shearing stress which acts on the circuit pattern 10 have been printed at whose time of making the screen mask 3 estrange after the end of printing. In the figure, when pulling up the screen mask 3, the shearing stress of the direction shown in the part enclosed with the round mark which touches the open end porous wall side of the opening 3a for wiring of the screen mask 3 in the printed circuit pattern 10 by an arrow acts intensively.

[0030]Now, temporarily, in not forming the residual paste 7a like this embodiment, A piece will arise in the above-mentioned stress concentration part in the circuit pattern 10, a dent will

occur in the upper bed side of the circuit pattern 10 after pulling up the screen mask 3, and the thickness of the circuit pattern 10 will decrease by the above-mentioned dent. On the other hand, when the residual paste 7a is formed, the adhesive power of the circuit pattern 10 in the above-mentioned stress concentration part declines by existence of the residual paste 7a, and the adhesion force to the open end porous wall side of the opening 3a for wiring of the circuit pattern 10 of a stress concentration part also declines in connection with it. Therefore, to the circuit pattern 10 in a stress concentration part, since the shearing force at the time of pulling up the screen mask 3 is markedly alike, is reduced and a piece does not arise, only in the part in which the quantity of the paste 7 for printing which a dent etc. do not produce the printed circuit pattern 10 in the upper bed side, and also remains in the opening 3a for wiring of the screen mask 3 decreases, thickness becomes large.

[0031]When the residual paste 7a is formed on the screen mask 3 of the thickness of 0.1 mm at the thickness of 100 μ m according to the measured result, One third of the residual volume of the paste 7 for printing when the quantity of the paste 7 for printing which remains in the opening 3a for wiring carries out the conventional presswork using the screen mask 3 of the same thickness as the above was able to be decreased. If it puts in another way, in this presswork, accuracy when controlling the printing amount to the printing substrate 1 of the paste 7 for printing can be raised by about 3 times by controlling the thickness of the residual paste 7a by conditioning of the print head 8 to an appropriate value.

[0032]The cutting front view showing the outline composition of the printer of the printed circuit board concerning the 1 embodiment of this invention for drawing 5 to put each printing method of the above-mentioned embodiment in practical use, Drawing 6 is a cutting side view showing the outline composition of the printer, and has given the same numerals to the thing the same as that of drawing 1 thru/or drawing 4, or equivalent in these figures. On the stage 2 for printing, the spacer 11 for support of the rail-like couple which has predetermined thickness in the part which approaches the both side surfaces of the printing substrate 1 of this, respectively is laid. The screen mask 3 is installed in the state of building on the spacer 11 for support of the couple, and is being fixed to the height position which carries out for relativity at the predetermined intervals d to the printing substrate 1. That is, the spacer 11 for support has the thickness which added the thickness of the printing substrate 1 to the setting-out thickness of the circuit pattern which should be formed on the printing substrate 1. The same spacer 11 for support of the couple is arranged at interval which can support the both ends of the print head 8 via the screen mask 3 so that it may show clearly in drawing 5.

[0033]Below, the print head 8 is horizontally explained about linear movement and the mechanism to move up and down. To the guide shaft 18 which the nut member 14 is screwed in the ball screw 13 rotated with the servo motor 12, and has been arranged in parallel with the above-mentioned ball screw 13. The mounting member 17 provided in one at the nut member 14 made the guide shaft 18 insert in the guide hole 17a of this, and has clung, enabling free sliding. Thereby, the mounting member 17 moves along with the guide shaft 18, when the ball screw 13 rotates. The air cylinder 19 hung to this mounting member 17, it has adhered to the state, and the print head 8 is attached to the tip part of the piston rod 19a of that air cylinder 19 with the screw thread 20. Drive controlling of the servo motor 12 and the air cylinder 19 is carried out by the controller 21.

[0034]Below, an operation of the above-mentioned printer is explained. First, the printing substrate 1 is set to the prescribed position on the stage 2 for printing, and the spacer 11 for support of a couple is mutually installed in the part close to the both-sides end of the printing substrate 1 by parallel arrangement. On the other hand, in the state where the screen mask 3 was held in the print point in the predetermined height position, the paste 7 for printing is supplied to the upper surface. Then, it positions so that for [of the printing substrate 1 which the stage 2 for printing moves and is set to this] relativity may be carried out in the lower part of this to the screen mask 3. After it, the screen mask 3 is laid in the state of descending and building on the spacer 11 for support of a couple, and is positioned by the predetermined interval d set up by the thickness of the spacer 11 for support to the printing substrate 1.

[0035]Next, the controller 21 is controlled to carry out the suction operation of the air cylinder 19, and the print head 8 is made to be pulled up to the height position which does not contact the screen mask 3. Then, control the controller 21 to turn the servo motor 12 to an opposite direction, and to rotate, and the mounting member 17 is moved, meeting the guide shaft 18, The print head 8 is positioned so that the printing initial position of the screen mask 3 may be countered, and operation control is carried out so that the regurgitation only of the stroke beforehand set up to the air cylinder 19 after it may be carried out. Thereby, the print head 8 which has adhered at the tip of the piston rod 19a of the air cylinder 19 is forced with the printing pressure beforehand set up to the screen mask 3. Next, the controller 21 is controlled to turn the servo motor 12 for Masakata and to rotate, holding the air cylinder 19 to the above-mentioned discharging state, and moves the print head 8 to a print direction. Thereby, on the printing substrate 1, print formation of the circuit pattern of specified shape is carried out with the paste 7 for printing which adhered through the opening for wiring of the screen mask 3.

[0036]Since it moves in the above-mentioned presswork while the both-ends portion of the print head 8 is supported with the spacer 11 for support of a couple via the screen mask 3, Since thickness, the interval d, i.e., the circuit pattern, to the printing substrate 1 of the screen mask 3, can be set up by choosing and installing the spacer 11 for support which has desired thickness, it can always be certainly held to a predetermined value, without needing a complicated control circuit etc. The printing pressure to the screen mask 3 of the print head 8 is controlled by the appropriate value when the controller 21 controls the regurgitation stroke of the air cylinder 19, and thereby, the print head 8 is swept, always holding a predetermined height position. After the angle to the screen mask 3 of the print head 8 loosens the screw thread 20, adjustable setting of it is carried out, and it can be set up and fixed to any value by bolting the screw thread 20 again. Therefore, this printer can embody faithfully any printing method of 1st and 2nd embodiments mentioned above, and can put it in practical use.

[0037]

[Effect of the Invention]Since the quality of printed matter is made to adhere to a printing substrate as mentioned above, without contacting a mask to a printing substrate according to the printing method of the printed circuit board of this invention, the thickness of the circuit pattern by which print formation is carried out on a printing substrate is mostly in agreement with the interval of a printing substrate and a mask regardless of the thickness of a mask. Therefore, the thickness of a circuit pattern can be set as any value by changing a mask into arbitrary intervals to a printing substrate. Since the thickness of a circuit pattern can be set up regardless of the thickness of a mask, thickness of a mask can be made thin as much as possible. Thereby, in this printing method, even if it is a detailed circuit pattern and a minute land for connection, it becomes possible to carry out print formation to the specified shape which has necessary thickness and does not have a chip etc. certainly. And since a circuit pattern can be formed by 1 time of the presswork using the same mask, increase of a manufacturing cost is not caused.

[0038]Since it had composition provided with the mask support which supports a mask at a predetermined interval to a printing substrate, and the control section which controls the thrust to the mask of the print head according to the printer of the printed circuit board of this invention, The printing method of this invention can be embodied faithfully and the same effect as a printing method can be acquired certainly.

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TECHNICAL FIELD

[Field of the Invention]This invention relates to the method and printer which print a circuit pattern to a printing substrate when manufacturing the printed circuit board which mounts electronic parts in a necessary place and is used for the circuitry of electronic equipment.

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PRIOR ART

[Description of the Prior Art]In recent years, the densification of a circuit pattern and high integration are demanded of the printed circuit board with miniaturization of electronic equipment.

It is small, and in order to realize highly efficient-ization, multilayering is further promoted from one side wiring by double-side wiring.

Generally this printed circuit board thermosetting resin Paper, synthetic fiber cloth, To the printing substrate which consists of a laminate sheet produced by carrying out press working of sheet metal after accumulating the thing with which it was spreading-impregnated and, which substrates, such as a woven glass fabric and a nonwoven glass fabric, were made to dry. Mainly by the presswork using the print heads, such as a squeegee, a circuit pattern and the beer hall for interlayer connections are formed, and it is manufactured. In presswork, since very much conditioning, such as hardness of the print head, an angle of gradient, printing pressure, and movement speed, occurs and the difference of slight conditioning affects quality, conditioning is adjusted based on experience in a manufacture site, and improvement in the process yield is aimed at.

[0003]It explains referring to for the general printing method of the circuit pattern in the manufacturing process of the conventional printed circuit board the sectional view of drawing 7 in which the presswork was shown typically next. The printing substrate 1 is set on the stage 2 for printing, few gaps are consisted above the printing substrate 1, and the screen mask 3 is arranged. The screen mask 3 is stuck on the screen frame 4, and the paste 7 for printing is supplied on the screen mask 3. For example, the print head 8 which consists of squeegees is made to adhere on the printing substrate 1 through the opening 3a for wiring for forming the circuit pattern of the screen mask 3 in the state of plastering the screen mask 3 with the paste 7 for printing. This print head 8 is formed in the print direction shown by the sliding direction and a graphic display arrow movable, respectively.

[0004]In the above-mentioned presswork, while the printing substrate 1 is set to the prescribed position on the stage 2 for printing, It positions so that for [of the printing substrate 1 which the paste 7 for printing is supplied on the screen mask 3, then the stage 2 for printing moves, and is set to this] relativity may be carried out by parallel arrangement in the lower part of this to the screen mask 3. After it, the screen mask 3 descends and is positioned by the predetermined interval to the printing substrate 1.

[0005]Next, the screen mask 3 is caudad depressed by the print head 8 which descended, and is lightly contacted by the printing substrate 1 by it. The print head 8 is swept in the print direction, with the above-mentioned height position held. Thereby, the paste 7 for printing on the screen mask 3 is moved while the screen mask 3 is plastered by the print head 8, and the screen mask 3 which has elasticity returns to the original position from the printing substrate 1 by own stability, immediately after the print head 8 passes. Then, it adheres to the paste 7 for printing on the printing substrate 1 from the opening 3a for wiring of the screen mask 3, and print formation of the circuit pattern is carried out on the printing substrate 1.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention]Since the quality of printed matter is made to adhere to a printing substrate as mentioned above, without contacting a mask to a printing substrate according to the printing method of the printed circuit board of this invention, the thickness of the circuit pattern by which print formation is carried out on a printing substrate is mostly in agreement with the interval of a printing substrate and a mask regardless of the thickness of a mask. Therefore, the thickness of a circuit pattern can be set as any value by changing a mask into arbitrary intervals to a printing substrate. Since the thickness of a circuit pattern can be set up regardless of the thickness of a mask, thickness of a mask can be made thin as much as possible. Thereby, in this printing method, even if it is a detailed circuit pattern and a minute land for connection, it becomes possible to carry out print formation to the specified shape which has necessary thickness and does not have a chip etc. certainly. And since a circuit pattern can be formed by 1 time of the presswork using the same mask, increase of a manufacturing cost is not caused.

[0038]Since it had composition provided with the mask support which supports a mask at a predetermined interval to a printing substrate, and the control section which controls the thrust to the mask of the print head according to the printer of the printed circuit board of this invention, The printing method of this invention can be embodied faithfully and the same effect as a printing method can be acquired certainly.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, in the above-mentioned presswork, the screen mask 3 is pushed against the printing substrate 1 by the thrust of the print head 8, Since print formation of the circuit pattern 9 is carried out by making the paste 7 for printing adhere on the printing substrate 1 through the opening 3a for wiring of the screen mask 3, the thickness of the circuit pattern 9 becomes only a slightly larger grade than the thickness of the screen mask 3 inevitably. On the other hand, since the pore shape of the opening 3a for wiring of the screen mask 3 for forming this becomes very small for example, in forming the minute land for connection corresponding to the miniaturization of electronic parts, it becomes difficult to supply the paste 7 for printing smoothly on the printing substrate 1. As a result, in the paste 7 for printing with which the opening 3a for wiring of very small pore shape was filled up, the part remains in the opening 3a for wiring, Since the minute land for connection printed with the paste 7 for printing of this quantity that ran short has insufficient thickness or a chip arises in shape, faults, such as omission etc. of the electronic parts mounted in this land for connection, are caused, and the yield of the electronic packaging circuit board falls.

[0007]On the other hand, although high density is demanded with miniaturization of electronic equipment in recent years, the circuit pattern needs to make width of wiring small, in order to attain the densification. However, in the conventional presswork, since it is difficult to form the wiring which has big thickness as mentioned above, when width of wiring is made small under such a situation, the new problem that the current capacity determined by the width and thickness of wiring will become small occurs. Therefore, in the conventional presswork, since thickness of wiring cannot be enlarged, width of wiring cannot be made small, either but this has become a factor which checks the densification of a circuit pattern.

[0008]Then, in order to cancel above-mentioned fault, by enlarging thickness of the screen mask 3, capacity in the opening 3a for wiring is also enlarged, and can consider giving big wiring of thickness. However, when it is made such, to formation of the comparatively large-sized land for connection for electronic parts, it is convenient, but. In forming a detailed circuit pattern and the minute land for connection, The opening 3a for wiring for forming the circuit pattern serves as slender sectional shape in connection with the thickness of the screen mask 3 becoming large in the thickness direction of the screen mask 3, and the smooth supply to the printing substrate 1 of the paste 7 for printing becomes difficult. That is, in the screen mask 3 with big thickness, neither a detailed circuit pattern nor the minute land for connection can be formed.

[0009]The screen mask 3 with comparatively big thickness which has the opening 3a for wiring for on the other hand forming the land for connection of only large-sized electronic parts, Preparing two kinds of the screen masks 3 with comparatively small thickness which have the opening 3a for wiring for forming a detailed circuit pattern and the minute land for connection is also considered. However, since the number and presswork of the screen mask 3 increase when [both] it is made such, increase of a manufacturing cost is caused.

[0010]In the former, the above-mentioned presswork is preceded as one of the measures against the above faults, In the part which should form a circuit pattern with the screen mask 3 in the printing substrate 1. After performing plating processing and supplying a constant rate of pastes 7 for printing beforehand, Use the screen mask 3 for the adhesion part of the paste for

printing, and supply the paste 7 for printing of an insufficiency, or, Conversely, after using the screen mask 3 for the printing substrate 1 and printing the circuit pattern 9 by the paste 7 for printing, on the circuit pattern, the paste for printing of an insufficiency is supplied and it corresponds. However, in such a means, the presswork of the paste 7 for printing increases and a manufacturing cost costs dearly.

[0011]Then, the circuit pattern and the land for connection for which it has the big thickness which this invention was made in view of the above-mentioned conventional technical problem, and was set up arbitrarily, It aims at providing the printing method and printer of a printed circuit board which can be formed on a printing substrate without causing increase of a manufacturing cost, and generating of the fault as a circuit pattern.

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MEANS

[Means for Solving the Problem]To achieve the above objects, a printing method of a printed circuit board of this invention, It arranges so that for [of the mask which has an opening for wiring for forming a circuit pattern] relativity may be carried out at the parallel and predetermined intervals to a printing substrate, By passing said opening for wiring and making it adhere on said printing substrate, moving quality of printed matter put on said mask by the print head, When carrying out print formation of the predetermined circuit pattern by said quality of printed matter which adhered on said printing substrate and moving said quality of printed matter by said print head, it is characterized by holding said mask so that said printing substrate may not be contacted.

[0013]In a printing method of this printed circuit board, since quality of printed matter is made to adhere to a printing substrate, without contacting a mask to a printing substrate, thickness of a circuit pattern by which print formation is carried out on a printing substrate is mostly in agreement with an interval of a printing substrate and a mask regardless of thickness of a mask. Therefore, thickness of a circuit pattern can be set as any value by changing a mask into arbitrary intervals to a printing substrate. Since thickness of a circuit pattern can be set up regardless of thickness of a mask, thickness of a mask can be made thin as much as possible. In this printing method, these enable it to carry out print formation to specified shape which has necessary thickness and does not have a chip etc. certainly, even if it is a detailed circuit pattern and a minute land for connection. And since a circuit pattern can be formed by 1 time of presswork using the same mask, increase of a manufacturing cost is not caused.

[0014]In the above-mentioned invention, while fixing to a relative position which has a predetermined gap to a printing substrate at the time of movement of quality of printed matter according a mask to the print head, it is preferred to give thrust within limits by which said mask is not bent to said print head.

[0015]Thereby, since an interval of a mask and a printing substrate is certainly held over the whole at constant value also at the time of movement of quality of printed matter by the print head, it can be formed in thickness which set up a circuit pattern certainly over the whole.

[0016]In the above-mentioned invention, it is preferred to move said quality of printed matter, making a part of quality of printed matter the print head remain on a mask. By this, when pulling up a mask after an end of printing, shearing stress acts on a part adjacent to an open end porous wall side of an opening for printing of a mask in a printed circuit pattern intensively, but. Adhesive power of a circuit pattern in this stress concentration part declines by existence of quality of printed matter which remains on a mask, and adhesion force to an open end porous wall side of an opening for printing of a circuit pattern of a stress concentration part also declines in connection with it. Therefore, to a circuit pattern in a stress concentration part. since shearing force at the time of pulling up a mask is markedly alike, is reduced and a piece does not arise, only in a part in which quantity of quality of printed matter which a dent etc. do not produce a printed circuit pattern in the upper bed side, and also remains in an opening for printing of a mask decreases, thickness becomes large.

[0017]Quantity of quality of printed matter which remains on a mask in the above-mentioned invention after the print head passes, It can set up by controlling at least one of the movement

speed of an angle to said mask of said print head, thrust to said mask of said print head, and said print head. . [whether this arranges the print head so that an angle to a mask may become small, and it is made to incline greatly towards the move direction, and] If which means is adopted even if there are whether a pressure to a mask of the print head is set up small a little or movement speed of the print head is set [little] up late slightly, Since power which scratches quality of printed matter on a mask by the print head declines, a little quality of printed matter can be made to remain on a mask after the print head passes.

[0018]On the other hand, a printer of a printed circuit board of this invention, A stage for printing to which a printing substrate for forming a circuit pattern is set, Mask support supported by arrangement which carries out for [of the mask which has an opening for wiring for forming a circuit pattern] relatively at the predetermined intervals to said printing substrate, The print head which passes said opening for wiring and is made to adhere on said printing substrate moving quality of printed matter put on said mask to a print direction, A head attachment component which supports said print head enabling free up-and-down motion, and a head transfer mechanism which moves said head attachment component to a print direction, It is characterized by having a control section which controls thrust to said mask of said print head by adjustment of a lower limit position of said head attachment component, and being constituted.

[0019]In a printer of this printed circuit board, since it has mask support which supports a mask at a predetermined interval to a printing substrate, and a control section which controls thrust to a mask of the print head, a printing method of this invention can be embodied faithfully and an effect of a printing method can be acquired certainly.

[0020]Mask support consists of two or more spacers for support which have predetermined thickness and intervene between a stage for printing, and a mask in the above-mentioned invention, and said each spacer for support, It is preferred to have composition currently installed on said stage for printing by arrangement which can support both ends of the print head which can be laid in the state where said mask builds between each upper surfaces and, where it moves via said mask.

[0021]Since it moves by this while a both-ends portion of the print head is supported with two or more spacers for support via a mask, thickness, an interval, i.e., a circuit pattern, to a printing substrate of a mask, Since it can set up by choosing and installing a spacer for support which has desired thickness, it can always hold certainly to a predetermined value, without needing a complicated control circuit etc.

[0022]

[Embodiment of the Invention][It explains in detail, referring to drawings for the desirable embodiment of this invention hereafter. Drawing 1 is an outline sectional view showing typically the presswork which embodied the printing method of the printed circuit board concerning a 1st embodiment of this invention, in the figure, gives the same numerals to a thing the same as that of drawing 7, or equivalent, and omits the overlapping explanation. Although presswork concerning this embodiment is performed using the same composition as the presswork of drawing 7, That it is different from the presswork of drawing 7 is only a point which makes the paste 7 for printing adhere on the screen mask 3, and forms a circuit pattern, making only the interval d which set up the screen mask 3 arbitrarily to the printing substrate 1 estrange, and always holding the above-mentioned interval d also in the case of movement of the print head 8.

[0023]By drawing 2's being an outline sectional view showing typically the state under print operation in the above-mentioned presswork, and plastering the screen mask 3 with the paste 7 for printing by movement of the print head 8, The paste 7 for printing which passed the opening 3a for wiring for forming the circuit pattern of the screen mask 3 adheres to the printing substrate 1, and print formation of the circuit pattern 10 by the paste 7 for printing is carried out to the printing substrate 1. At this time, the print head 8 is set as the pressure which does not sag the screen mask 3, and the screen mask 3 continues holding the relative position which maintains the interval d always set up to the printing substrate 1 at the time of the print

operation by movement of the print head 8.

[0024]Therefore, the thickness of the circuit pattern 10 by which print formation is carried out on the printing substrate 1 is mostly in agreement with the interval d of the printing substrate 1 and the screen mask 3 regardless of the thickness of the screen mask 3. For example, when the thickness of the screen mask 3 is 0.1 mm and the interval d of the printing substrate 1 and the screen mask 3 is 0.5 mm. The circuit pattern 10 will be formed in the thickness of 0.5 mm, and this thickness will be about 5 times as compared with the thickness (about 0.1 mm which was in agreement with the thickness of the screen mask 3) of the circuit pattern 9 formed of the conventional presswork.

[0025]Variable setting out of the thickness of the circuit pattern 10 can be arbitrarily carried out changing the screen mask 3 into the arbitrary intervals d to the printing substrate 1, and fixing, and by controlling the pressure to the screen mask 3 of the print head 8. Since the thickness of the circuit pattern 10 can be set up regardless of the thickness of the screen mask 3, thickness of the screen mask 3 can be made thin as much as possible. Thereby, in the above-mentioned presswork, even if it is a detailed circuit pattern and a minute land for connection, it becomes possible to carry out print formation to the specified shape which has necessary thickness and does not have a chip etc. certainly.

[0026]And in the above-mentioned presswork, since only the part to which the width of wiring becomes small in connection with it can set up the thickness of wiring greatly when attaining minuteness making of the circuit pattern 10, the detailed circuit pattern 10 which has necessary current capacity can be obtained. By performing 1 time of presswork using the single screen mask 3 with small thickness in the above-mentioned presswork, since the thickness of the circuit pattern 10 can be arbitrarily set up regardless of the thickness of the screen mask 3, Since the print formation of each connecting land a detailed circuit pattern, for large-sized electronic parts, and for miniature electronic components can be carried out simultaneously, increase of a manufacturing cost is not caused.

[0027]Drawing 3 is an outline sectional view showing typically the presswork which embodied the printing method of the printed circuit board concerning a 2nd embodiment of this invention, in the figure, gives the same numerals to a thing the same as that of drawing 1, or equivalent, and omits the overlapping explanation. While the same composition is used for the presswork of this embodiment as compared with the presswork of drawing 1, Although it is the same in the point which prints by moving the print head 8 by making the paste 7 for printing adhere on the printing substrate 1, making only the interval d which set up the screen mask 3 arbitrarily to the printing substrate 1 estrange, and always holding this interval d , Only in the point which prints by moving the paste 7 for printing with remnants in small quantities on the screen mask 3 in the screen mask 3 top, the print head 8 is different. A little residual pastes 7a which remain on the screen mask 3 after the print head 8 passes, When pulling up the screen mask 3 above the printing substrate 1 after the end of printing, the mold-release characteristic over the screen mask 3 of the paste 10 for printing, i.e., a circuit pattern, printed to the printing substrate 1 is raised.

[0028]While making the print head 8 incline greatly in the presswork of this embodiment towards the move direction which is arranged so that the angle to the screen mask 3 may become small, and is shown by a graphic display arrow as compared with the presswork of a 1st embodiment, The pressure to the screen mask 3 was set up small a little, and movement speed is set up late slightly. Thereby, since the power which scratches the paste 7 for printing on the screen mask 3 declines, the print head 8 can move in the screen mask 3 top, producing the residual paste 7a. The thickness of this residual paste 7a can carry out adjustable setting arbitrarily by setting out or control of an angle, and a pressure and movement speed to the screen mask 3 of the above-mentioned print head 8.

[0029]Below, the effect by existence of the residual paste 7a is explained. In pulling up the screen mask 3 after the end of printing, the power into which the printed circuit pattern 10 is changed with the adhesive power to the screen mask 3 of the paste 7 for printing acts, but modification of the circuit pattern 10 begins from the portion which shearing stress

concentrates. Drawing 4 is an explanatory view of shearing stress which acts on the circuit pattern 10 have been printed at whose time of making the screen mask 3 estrange after the end of printing. In the figure, when pulling up the screen mask 3, the shearing stress of the direction shown in the part enclosed with the round mark which touches the open end porous wall side of the opening 3a for wiring of the screen mask 3 in the printed circuit pattern 10 by an arrow acts intensively.

[0030]Now, temporarily, in not forming the residual paste 7a like this embodiment, A piece will arise in the above-mentioned stress concentration part in the circuit pattern 10, a dent will occur in the upper bed side of the circuit pattern 10 after pulling up the screen mask 3, and the thickness of the circuit pattern 10 will decrease by the above-mentioned dent. On the other hand, when the residual paste 7a is formed, the adhesive power of the circuit pattern 10 in the above-mentioned stress concentration part declines by existence of the residual paste 7a, and the adhesion force to the open end porous wall side of the opening 3a for wiring of the circuit pattern 10 of a stress concentration part also declines in connection with it. Therefore, to the circuit pattern 10 in a stress concentration part. since the shearing force at the time of pulling up the screen mask 3 is markedly alike, is reduced and a piece does not arise, only in the part in which the quantity of the paste 7 for printing which a dent etc. do not produce the printed circuit pattern 10 in the upper bed side, and also remains in the opening 3a for wiring of the screen mask 3 decreases, thickness becomes large.

[0031]When the residual paste 7a is formed on the screen mask 3 of the thickness of 0.1 mm at the thickness of 100 μ m according to the measured result, One third of the residual volume of the paste 7 for printing when the quantity of the paste 7 for printing which remains in the opening 3a for wiring carries out the conventional presswork using the screen mask 3 of the same thickness as the above was able to be decreased. If it puts in another way, in this presswork, accuracy when controlling the printing amount to the printing substrate 1 of the paste 7 for printing can be raised by about 3 times by controlling the thickness of the residual paste 7a by conditioning of the print head 8 to an appropriate value.

[0032]The cutting front view showing the outline composition of the printer of the printed circuit board concerning the 1 embodiment of this invention for drawing 5 to put each printing method of the above-mentioned embodiment in practical use, Drawing 6 is a cutting side view showing the outline composition of the printer, and has given the same numerals to the thing the same as that of drawing 1 thru/or drawing 4, or equivalent in these figures. On the stage 2 for printing, the spacer 11 for support of the rail-like couple which has predetermined thickness in the part which approaches the both side surfaces of the printing substrate 1 of this, respectively is laid. The screen mask 3 is installed in the state of building on the spacer 11 for support of the couple, and is being fixed to the height position which carries out for relativity at the predetermined intervals d to the printing substrate 1. That is, the spacer 11 for support has the thickness which added the thickness of the printing substrate 1 to the setting-out thickness of the circuit pattern which should be formed on the printing substrate 1. The same spacer 11 for support of the couple is arranged at interval which can support the both ends of the print head 8 via the screen mask 3 so that it may show clearly in drawing 5.

[0033]Below, the print head 8 is horizontally explained about linear movement and the mechanism to move up and down. To the guide shaft 18 which the nut member 14 is screwed in the ball screw 13 rotated with the servo motor 12, and has been arranged in parallel with the above-mentioned ball screw 13. The mounting member 17 provided in one at the nut member 14 made the guide shaft 18 insert in the guide hole 17a of this, and has clung, enabling free sliding. Thereby, the mounting member 17 moves along with the guide shaft 18, when the ball screw 13 rotates. The air cylinder 19 hung to this mounting member 17, it has adhered to the state, and the print head 8 is attached to the tip part of the piston rod 19a of that air cylinder 19 with the screw thread 20. Drive controlling of the servo motor 12 and the air cylinder 19 is carried out by the controller 21.

[0034]Below, an operation of the above-mentioned printer is explained. First, the printing substrate 1 is set to the prescribed position on the stage 2 for printing, and the spacer 11 for

support of a couple is mutually installed in the part close to the both-sides end of the printing substrate 1 by parallel arrangement. On the other hand, in the state where the screen mask 3 was held in the print point in the predetermined height position, the paste 7 for printing is supplied to the upper surface. Then, it positions so that for [of the printing substrate 1 which the stage 2 for printing moves and is set to this] relativity may be carried out in the lower part of this to the screen mask 3. After it, the screen mask 3 is laid in the state of descending and building on the spacer 11 for support of a couple, and is positioned by the predetermined interval d set up by the thickness of the spacer 11 for support to the printing substrate 1.

[0035]Next, the controller 21 is controlled to carry out the suction operation of the air cylinder 19, and the print head 8 is made to be pulled up to the height position which does not contact the screen mask 3. Then, control the controller 21 to turn the servo motor 12 to an opposite direction, and to rotate, and the mounting member 17 is moved, meeting the guide shaft 18, The print head 8 is positioned so that the printing initial position of the screen mask 3 may be countered, and operation control is carried out so that the regurgitation only of the stroke beforehand set up to the air cylinder 19 after it may be carried out. Thereby, the print head 8 which has adhered at the tip of the piston rod 19a of the air cylinder 19 is forced with the printing pressure beforehand set up to the screen mask 3. Next, the controller 21 is controlled to turn the servo motor 12 for Masakata and to rotate, holding the air cylinder 19 to the above-mentioned discharging state, and moves the print head 8 to a print direction. Thereby, on the printing substrate 1, print formation of the circuit pattern of specified shape is carried out with the paste 7 for printing which adhered through the opening for wiring of the screen mask 3.

[0036]Since it moves in the above-mentioned presswork while the both-ends portion of the print head 8 is supported with the spacer 11 for support of a couple via the screen mask 3, Since thickness, the interval d , i.e., the circuit pattern, to the printing substrate 1 of the screen mask 3, can be set up by choosing and installing the spacer 11 for support which has desired thickness, it can always be certainly held to a predetermined value, without needing a complicated control circuit etc. The printing pressure to the screen mask 3 of the print head 8 is controlled by the appropriate value when the controller 21 controls the regurgitation stroke of the air cylinder 19, and thereby, the print head 8 is swept, always holding a predetermined height position. After the angle to the screen mask 3 of the print head 8 loosens the screw thread 20, adjustable setting of it is carried out, and it can be set up and fixed to any value by bolting the screw thread 20 again. Therefore, this printer can embody faithfully any printing method of 1st and 2nd embodiments mentioned above, and can put it in practical use.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The outline sectional view showing typically the presswork which embodied the printing method of the printed circuit board concerning a 1st embodiment of this invention.

[Drawing 2]The outline sectional view showing typically the state under print operation in an embodiment same as the above.

[Drawing 3]The outline sectional view showing typically the presswork which embodied the printing method of the printed circuit board concerning a 2nd embodiment of this invention.

[Drawing 4]The explanatory view of shearing stress which acts on the printed circuit pattern at the time of pulling up a screen mask after the end of print operation in an embodiment same as the above.

[Drawing 5]The cutting front view showing the outline composition of the printer of the printed circuit board concerning the 1 embodiment of this invention.

[Drawing 6]The cutting side view showing the outline composition of a printer same as the above.

[Drawing 7]The sectional view showing the presswork in the conventional printed circuit board typically.

[Description of Notations]

1 Printing substrate

2 The stage for printing

3 Screen mask (mask)

3a The opening for wiring

7 The paste for printing (quality of printed matter)

7a Residual paste

8 Print head

10 Circuit pattern

11 The spacer for support (mask support)

15 Head transfer mechanism

19 Air cylinder (head attachment component)

21 Controller (control section)

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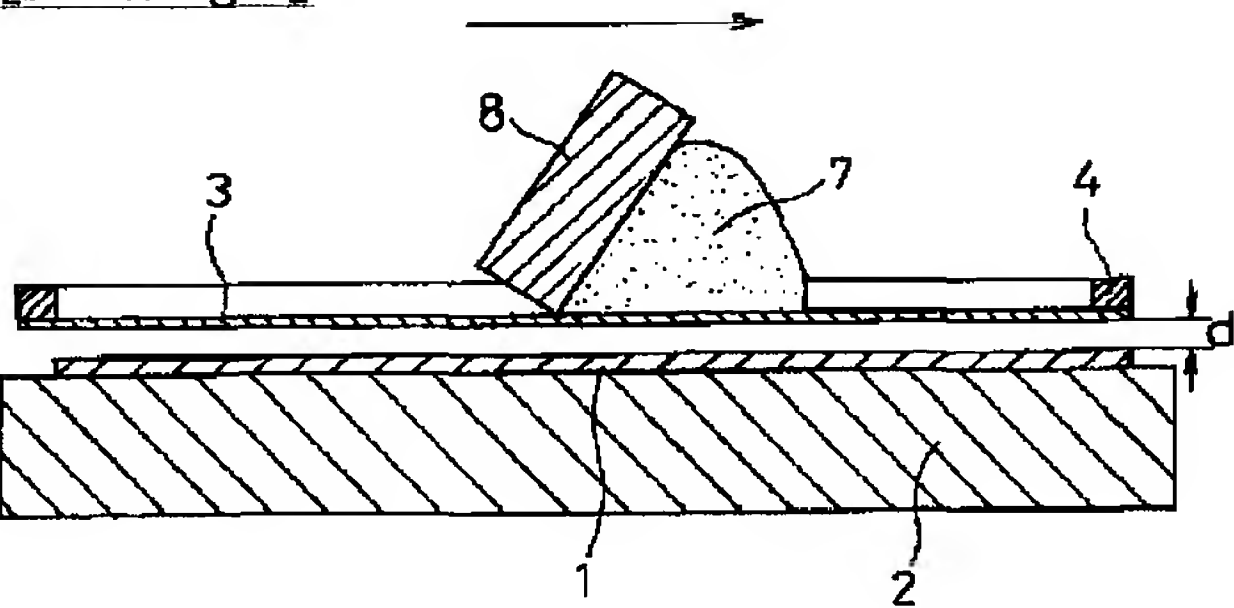
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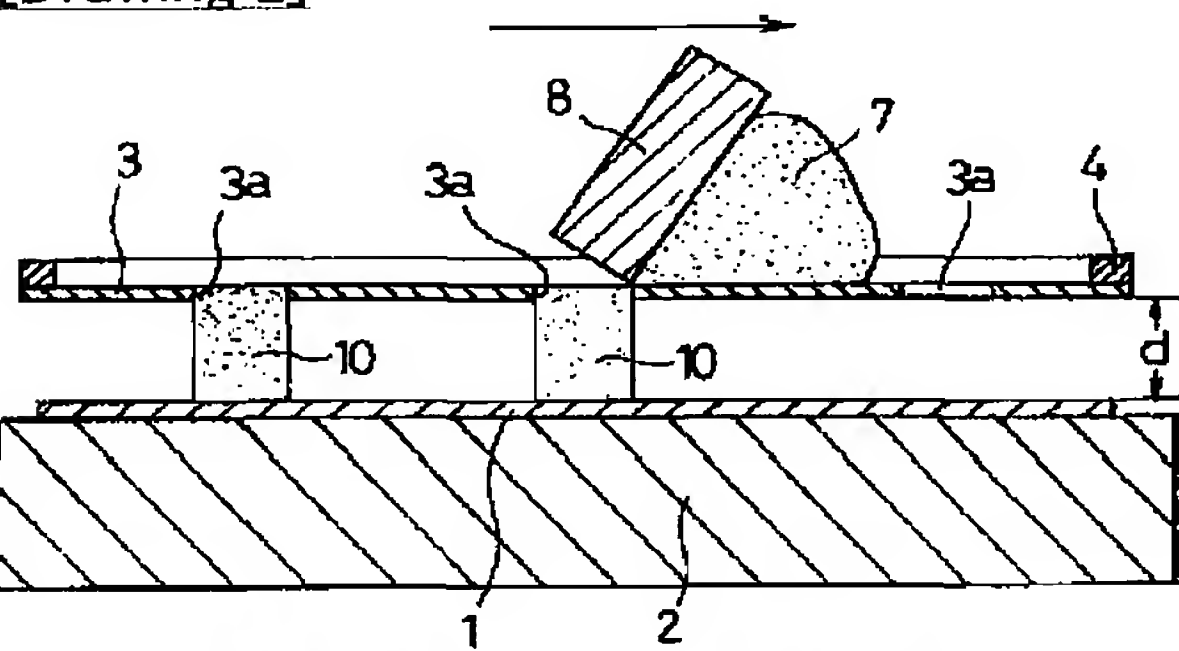
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DRAWINGS

[Drawing 1]

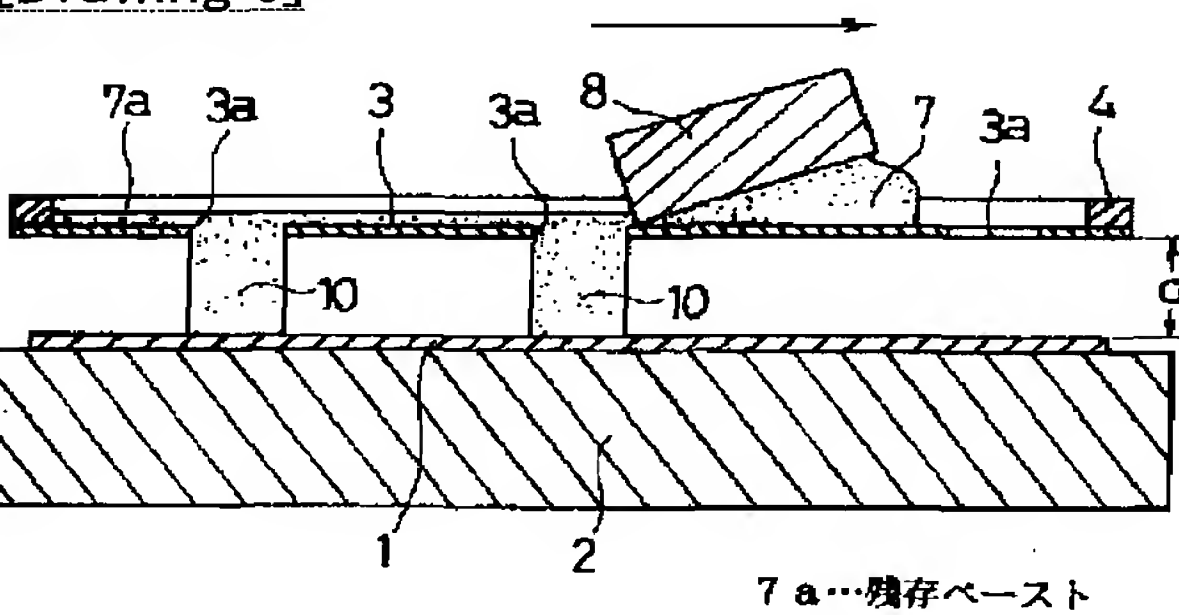


[Drawing 2]



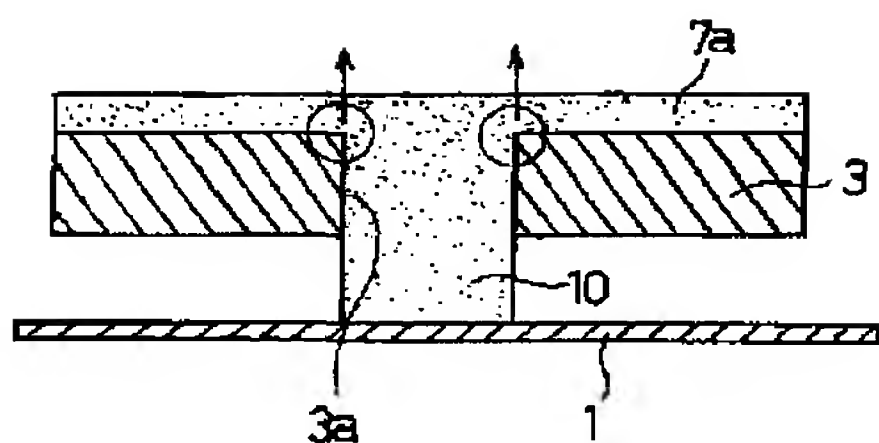
- | | |
|--------------|-------------|
| 1...被印刷基材 | 7...印刷用ペースト |
| 2...印刷用ステージ | (印刷物質) |
| 3...スクリーンマスク | 8...印刷ヘッド |
| (マスク) | 10...配線パターン |
| 3a...配線用開口部 | |

[Drawing 3]

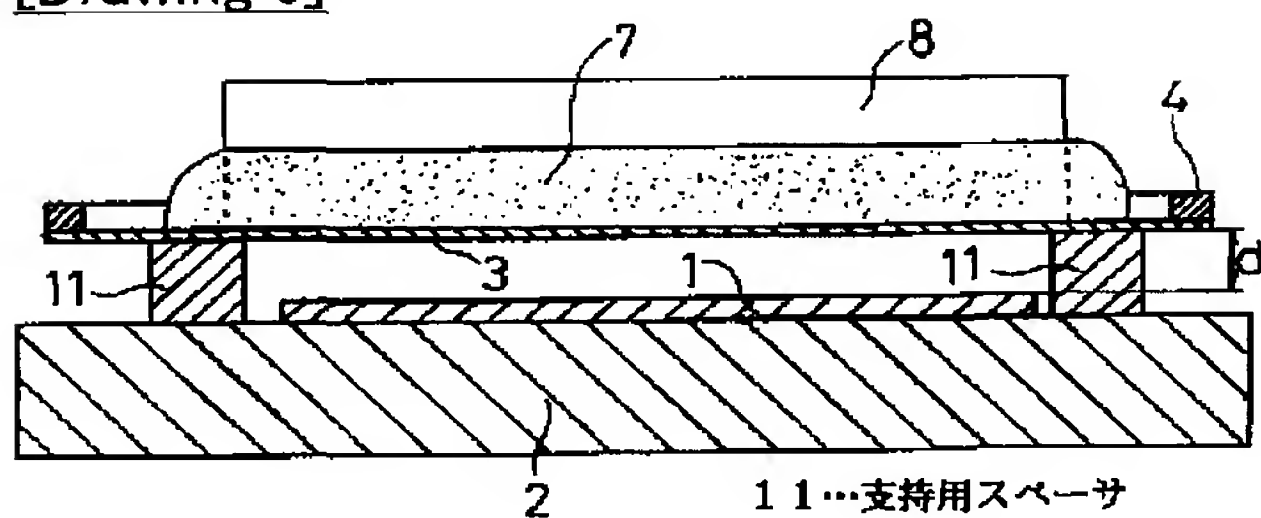


7a...残存ペースト

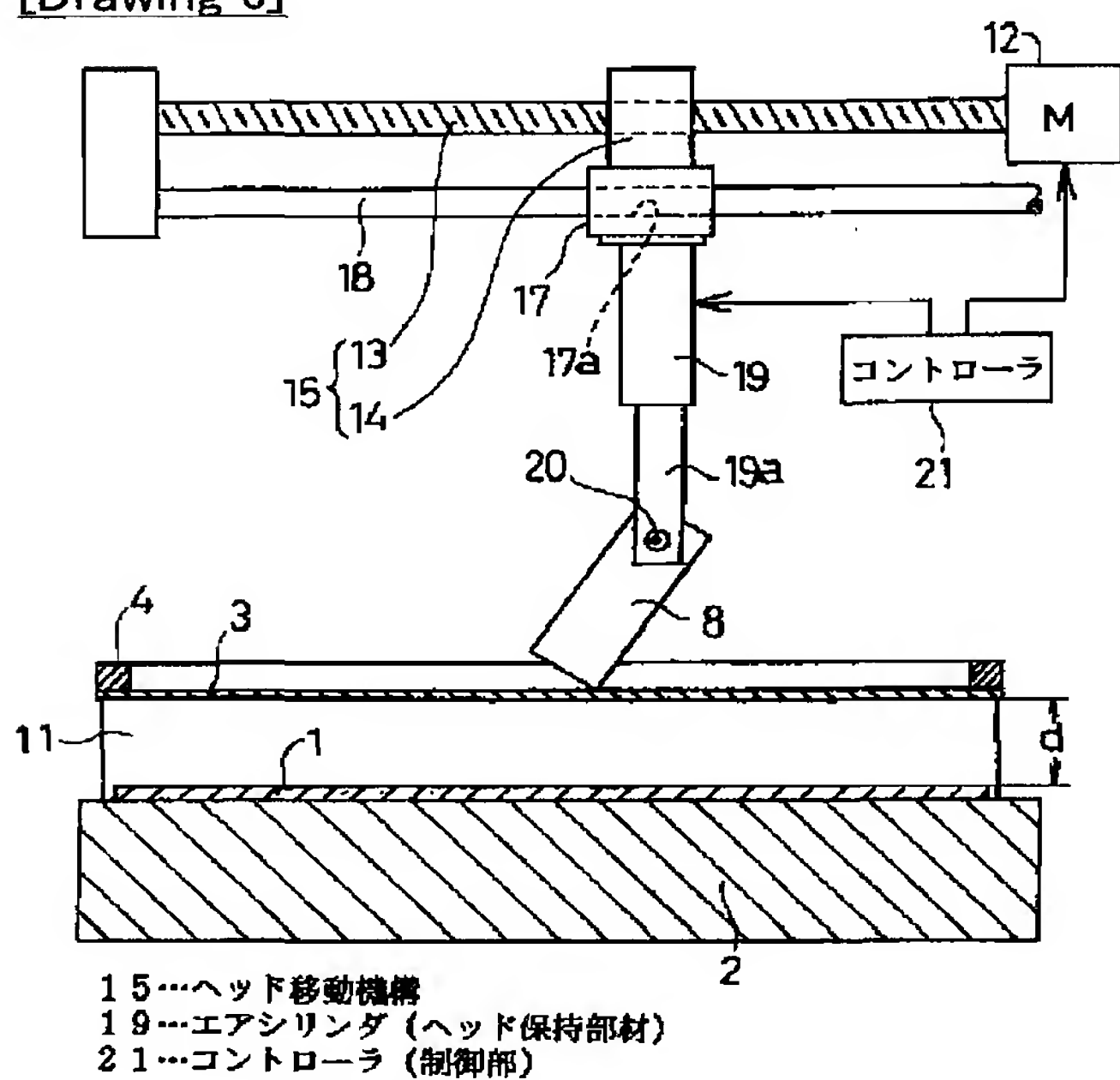
[Drawing 4]



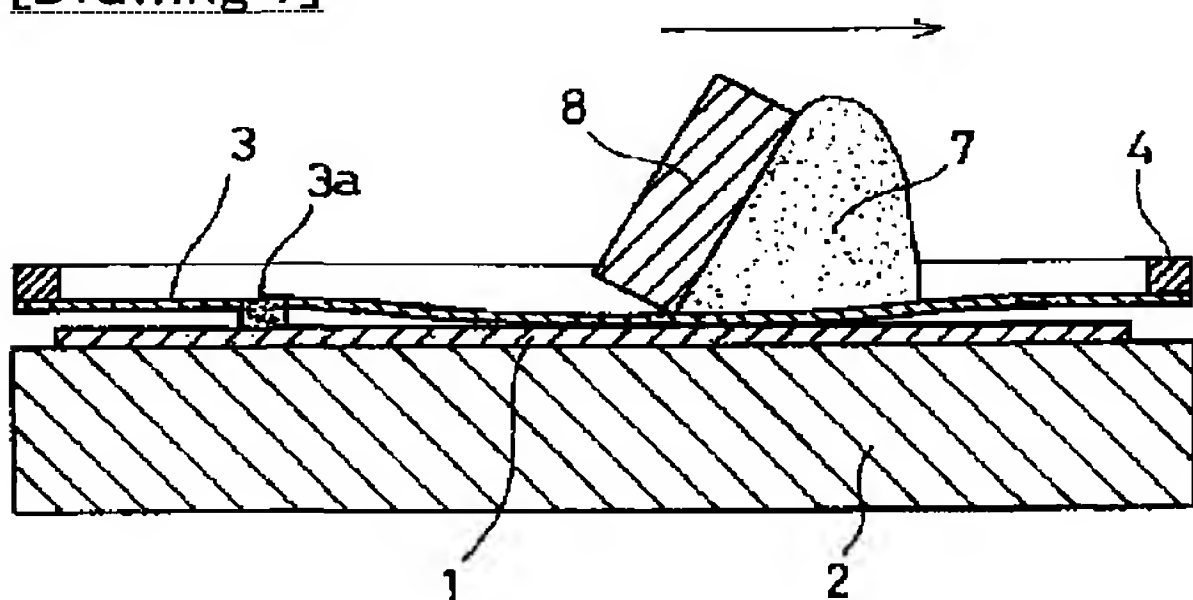
[Drawing 5]



[Drawing 6]



[Drawing 7]



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METHOD AND APPARATUS FOR PRINTING PRINTED CIRCUIT BOARD

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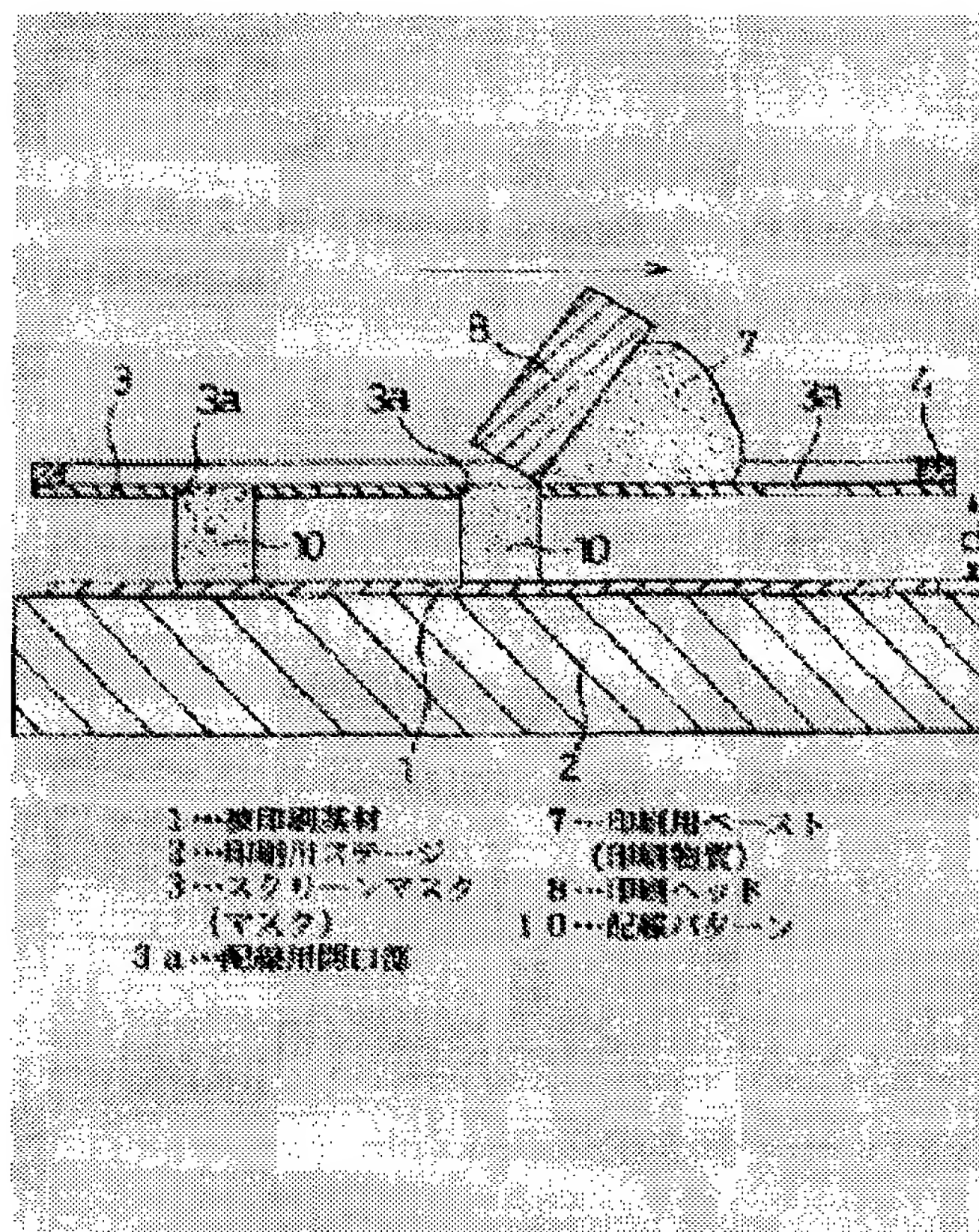
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Abstract of JP2002103561

PROBLEM TO BE SOLVED: To provide a method and an apparatus for printing a printed circuit board capable of forming a wiring pattern having an arbitrarily set large thickness and a connecting land on a base to be printed without introducing an increase in a manufacturing cost or a fault as the wiring pattern. **SOLUTION:** The method for printing the printed circuit board comprises the step of disposing a mask 3 having openings 3a for wirings to form a wiring pattern 10 oppositely at a predetermined interval (d) parallel to the base 1 to be printed. The method further comprises the steps of passing a printing substance 7 carried on the mask 3 through the openings 3 while moving the substance 7 by a print head 8 to adhere the substance onto the base 1 to print and form a predetermined wiring pattern 10 with the substance 7 adhered onto the base 1. When the substance 7 is moved by the head 8, the mask 3 is held so as not to be contacted with the base 1.



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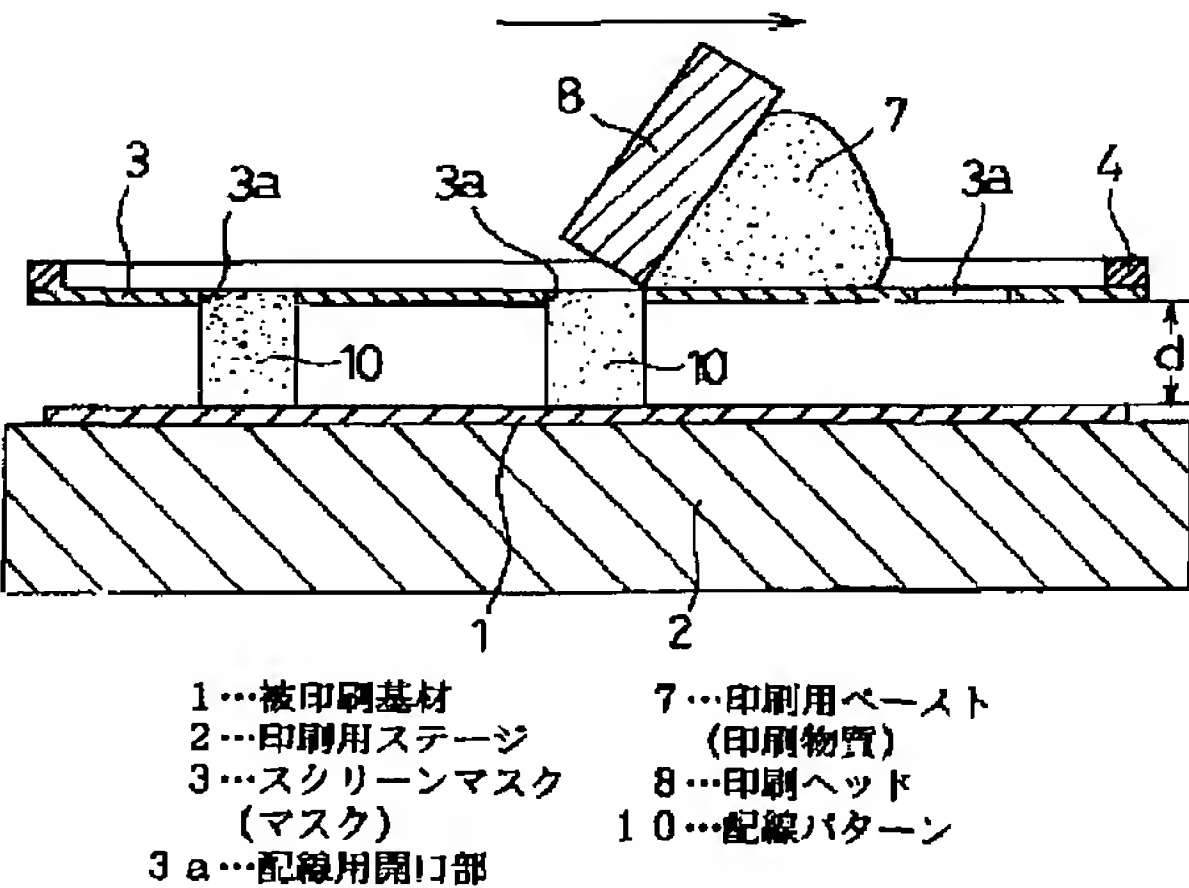
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(54) 【発明の名称】 プリント回路基板の印刷方法および印刷装置

(57) 【要約】

【課題】 任意に設定した大きな厚みを有する配線パターンおよび接続用ランドを、製造コストの増大や配線パターンとしての不具合の発生を招くことなしに被印刷基材上に形成することのできるプリント回路基板の印刷方法および印刷装置を提供する。

【解決手段】 配線パターン10を形成するための配線用開口部3aを有するマスク3を、被印刷基材1に対し平行で且つ所定の間隔dで相対向するように配置する。マスク3上に乗せた印刷物質7を、印刷ヘッド8により移動させながら配線用開口部3aを通過させて被印刷基材1上に付着させることにより、被印刷基材1上に付着した印刷物質7によって所定の配線パターン10を印刷形成する。印刷ヘッド8によって印刷物質7を移動させるときに、マスク3を被印刷基材1に接触しないように保持する。



【特許請求の範囲】

【請求項1】 配線パターンを形成するための配線用開口部を有するマスクを、被印刷基材に対し平行で且つ所定の間隔で相対向するように配置し、前記マスク上に乗せた印刷物質を、印刷ヘッドにより移動させながら前記配線用開口部を通過させて前記被印刷基材上に付着させることにより、前記被印刷基材上に付着した前記印刷物質によって所定の配線パターンを印刷形成し、前記印刷ヘッドによって前記印刷物質を移動させるときに、前記マスクを前記被印刷基材に接触しないように保持するようにしたことを特徴とするプリント回路基板の印刷方法。

【請求項2】 マスクを、印刷ヘッドによる印刷物質の移動時に被印刷基材に対し所定の間隙を有する相対位置に固定するとともに、前記印刷ヘッドに、前記マスクが撓まない範囲内の押圧力を付与するようにした請求項1に記載のプリント回路基板の印刷方法。

【請求項3】 印刷ヘッドを、マスク上に印刷物質の一部を残存させながら前記印刷物質を移動させるようにした請求項1または2に記載のプリント回路基板の印刷方法。

【請求項4】 印刷ヘッドが通過した後にマスク上に残存する印刷物質の量を、前記印刷ヘッドの前記マスクに対する角度、前記印刷ヘッドの前記マスクに対する押圧力および前記印刷ヘッドの移動速度の少なくとも一つを制御することによって設定するようにした請求項3に記載のプリント回路基板の印刷方法。

【請求項5】 配線パターンを形成するための被印刷基材がセットされる印刷用ステージと、配線パターンを形成するための配線用開口部を有するマスクを前記被印刷基材に対し所定の間隔で相対向する配置で支持するマスク支持体と、前記マスク上に乗せた印刷物質を印刷方向に移動させながら前記配線用開口部を通過させて前記被印刷基材上に付着させる印刷ヘッドと、前記印刷ヘッドを上下動自在に支持するヘッド保持部材と、前記ヘッド保持部材を印刷方向に移動させるヘッド移動機構と、前記ヘッド保持部材の下限位置の調整によって前記印刷ヘッドの前記マスクに対する押圧力を制御する制御部とを備えて構成されていることを特徴とするプリント回路基板の印刷装置。

【請求項6】 マスク支持体は所定の厚みを有して印刷用ステージとマスクとの間に介在される複数の支持用スペーサからなり、前記各支持用スペーサは、前記マスクが各々の上面間に架け渡す状態で載置でき、且つ移動する印刷ヘッドの両端部を前記マスクを介し支持できる配置で前記印刷用ステージ上に設置されている請求項5に

記載のプリント回路基板の印刷装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、所要箇所に電子部品を実装して電子機器の回路構成に用いられるプリント回路基板の製造に際して、被印刷基材に配線パターンを印刷する方法および印刷装置に関するものである。

【0002】

【従来の技術】近年、プリント回路基板には、電子機器のコンパクト化に伴って配線パターンの高密度化および高集積化が要求されており、小型で高性能化を実現するために片面配線から両面配線に、さらに多層化が促進されている。このプリント回路基板は、一般に、熱硬化性樹脂を紙、合成繊維布、ガラス布およびガラス不織布などの基材に塗布含浸および乾燥させたものを積み重ねたのちにプレス加工して作製される積層板からなる被印刷基材に、主としてスキージなどの印刷ヘッドを用いた印刷工程によって配線パターンや層間接続用ビアホールを形成して製造されている。印刷工程においては、印刷ヘッドの硬度、傾斜角度、印圧および移動速度などの極めて多くの条件設定があり、僅かな条件設定の差が品質に影響を与えるため、製造現場での経験に基づいて条件設定の調整を行い、工程歩留りの向上を図っている。

【0003】つぎに、従来のプリント回路基板の製造工程における配線パターンの一般的な印刷方法について、その印刷工程を模式的に示した図7の断面図を参照しながら説明する。被印刷基材1は印刷用ステージ2上にセットされ、被印刷基材1の上方には、僅かな間隙を存してスクリーンマスク3が配置される。スクリーンマスク3はスクリーン枠4に張り付けられており、そのスクリーンマスク3上には印刷用ペースト7が供給される。例えばスキージからなる印刷ヘッド8は、印刷用ペースト7をスクリーンマスク3に塗り付ける状態でスクリーンマスク3の配線パターンを形成するための配線用開口部3aを通じ被印刷基材1上に付着させる。この印刷ヘッド8は上下方向および図示矢印で示す印刷方向にそれぞれ移動可能に設けられている。

【0004】上記印刷工程では、印刷用ステージ2上の所定位置に被印刷基材1がセットされる一方、スクリーンマスク3上に印刷用ペースト7が供給され、続いて、印刷用ステージ2が移動してこれにセットされている被印刷基材1をスクリーンマスク3に対しこれの下方で平行な配置で相対向するよう位置決めする。そののち、スクリーンマスク3は下降されて被印刷基材1に対し所定の間隔に位置決めされる。

【0005】つぎに、スクリーンマスク3は、下降された印刷ヘッド8によって下方に押し下げられて、被印刷基材1に軽く接触される。印刷ヘッド8は、上記高さ位置を保持したまま印刷方向に掃引されていく。これにより、スクリーンマスク3上の印刷用ペースト7は、印刷

ヘッド8によってスクリーンマスク3に塗り付けられながら移動されていき、弾性を有するスクリーンマスク3は印刷ヘッド8が通過した直後に自身の復元力で被印刷基材1から元の位置に復帰する。そのときに、印刷用ペースト7はスクリーンマスク3の配線用開口部3aから被印刷基材1上に付着されて、被印刷基材1上に配線パターンが印刷形成される。

【0006】

【発明が解決しようとする課題】しかしながら、上記印刷工程では、スクリーンマスク3を印刷ヘッド8の押圧力で被印刷基材1に押し付けて、スクリーンマスク3の配線用開口部3aを通じ印刷用ペースト7を被印刷基材1上に付着させることによって配線パターン9を印刷形成しているため、配線パターン9の厚みは、必然的にスクリーンマスク3の厚みよりも僅かに大きい程度にしかない。これに対し、例えば、電子部品の小型化に対応した微小な接続用ランドを形成する場合には、これを形成するためのスクリーンマスク3の配線用開口部3aの孔形状が極めて小さくなるので、印刷用ペースト7を被印刷基材1上に円滑に供給するのが困難となる。その結果、極めて小さな孔形状の配線用開口部3aに充填された印刷用ペースト7はその一部が配線用開口部3a内に残留してしまい、この不足した量の印刷用ペースト7で印刷された微小な接続用ランドは、厚みが不十分であったり、形状に欠けが生じたりするので、この接続用ランドに実装された電子部品の脱落などの不具合を引き起こし、電子部品実装回路基板の歩留りが低下する。

【0007】一方、配線パターンは、近年の電子機器のコンパクト化に伴って高密度が要求されているが、その高密度化を図るためには配線の幅を小さくする必要がある。しかし、従来の印刷工程では上述したように大きな厚みを有する配線を形成するのが困難であるから、そのような状況下において配線の幅を小さくした場合には、配線の幅と厚みで決定される電流容量が小さくなってしまいうという新たな問題が発生する。したがって、従来の印刷工程では、配線の厚みを大きくできないことから、配線の幅を小さくすることもできず、これが配線パターンの高密度化を阻害する要因になっている。

【0008】そこで、上述の不具合を解消するために、スクリーンマスク3の厚みを大きくすることによって配線用開口部3a内の容積も大きくし、厚みの大きな配線を施すことが考えられる。ところが、そのようにした場合には、比較的大型の電子部品用の接続用ランドの形成などには好都合であるが、微細な配線パターンや微小な接続用ランドを形成する場合には、その配線パターンを形成するための配線用開口部3aが、スクリーンマスク3の厚みが大きくなるのに伴ってスクリーンマスク3の厚み方向に長細い断面形状となり、印刷用ペースト7の被印刷基材1へのスムーズな供給が困難となる。すなわち、厚みの大きなスクリーンマスク3では微細な配線パ

ターンや微小な接続用ランドを形成することができない。

【0009】一方、大型の電子部品のための接続用ランドを形成するための配線用開口部3aを有する比較的厚みの大きなスクリーンマスク3と、微細な配線パターンと微小な接続用ランドとを形成するための配線用開口部3aを有する比較的厚みの小さなスクリーンマスク3との2種類を用意することも考えられる。しかし、そのようにした場合には、スクリーンマスク3の個数と印刷工程が共に増えるので、製造コストの増大を招く。

【0010】また、従来では、上述のような不具合の対策の一つとして、上記印刷工程に先立って、被印刷基材1におけるスクリーンマスク3で配線パターンを形成すべき箇所に、めっき加工を施して予め一定量の印刷用ペースト7を供給したのちに、その印刷用ペーストの付着箇所にスクリーンマスク3を用いて不足分の印刷用ペースト7を供給したり、逆に被印刷基材1にスクリーンマスク3を用いて印刷用ペースト7による配線パターン9の印刷を行ったのちに、その配線パターン上に不足分の印刷用ペーストを供給したりして対応している。ところが、このような手段では、印刷用ペースト7の印刷工程が増えて製造コストが高つく。

【0011】そこで、本発明は、上記従来の課題に鑑みてなされたもので、任意に設定した大きな厚みを有する配線パターンおよび接続用ランドを、製造コストの増大や配線パターンとしての不具合の発生を招くことなしに被印刷基材上に形成することのできるプリント回路基板の印刷方法および印刷装置を提供することを目的とするものである。

【0012】

【課題を解決するための手段】上記目的を達成するために、本発明のプリント回路基板の印刷方法は、配線パターンを形成するための配線用開口部を有するマスクを、被印刷基材に対し平行で且つ所定の間隔で相対向するように配置し、前記マスク上に乗せた印刷物質を、印刷ヘッドにより移動させながら前記配線用開口部を通過させて前記被印刷基材上に付着させることにより、前記被印刷基材上に付着した前記印刷物質によって所定の配線パターンを印刷形成し、前記印刷ヘッドによって前記印刷物質を移動させるときに、前記マスクを前記被印刷基材に接触しないように保持するようにしたことを特徴としている。

【0013】このプリント回路基板の印刷方法では、マスクを被印刷基材に接触させずに印刷物質を被印刷基材に付着させるので、被印刷基材上に印刷形成される配線パターンの厚みが、マスクの厚みとは無関係に、被印刷基材とマスクとの間隔にほぼ一致する。したがって、配線パターンの厚みは、マスクを被印刷基材に対し任意の間隔に可変することによって任意の値に設定することができる。さらに、配線パターンの厚みはマスクの厚みと

は無関係に設定できるので、マスクの厚みは可及的に薄くすることができる。これらにより、この印刷方法では、微細な配線パターンや微小な接続用ランドであっても、所要の厚みを有し、且つ欠けなどの無い所定形状に確実に印刷形成することが可能となる。しかも、配線パターンは同一のマスクを用いた1回の印刷工程で形成できるので、製造コストの増大を招かない。

【0014】上記発明において、マスクを、印刷ヘッドによる印刷物質の移動時に被印刷基材に対し所定の間隔を有する相対位置に固定するとともに、前記印刷ヘッドに、前記マスクが撓まない範囲内の押圧力を付与することが好ましい。

【0015】これにより、マスクと被印刷基材との間隔は、印刷ヘッドによる印刷物質の移動時にもその全体にわたり確実に一定値に保持されるから、配線パターンを、その全体にわたり確実に設定した厚みに形成することができる。

【0016】また、上記発明において、印刷ヘッドを、マスク上に印刷物質の一部を残存させながら前記印刷物質を移動させることが好ましい。これにより、印刷終了後にマスクを引き上げる際には、印刷済みの配線パターンにおけるマスクの印刷用開口部の開口端孔壁面に接する箇所には、剪断応力が集中的に作用するが、この応力集中箇所における配線パターンの粘着力がマスク上に残留する印刷物質の存在によって低下し、それに伴い応力集中箇所の配線パターンの印刷用開口部の開口端孔壁面に対する付着力も低下する。そのため、応力集中箇所における配線パターンには、マスクを引き上げる際の剪断力が格段に低減されて切れが生じないので、印刷済みの配線パターンは、その上端面に凹みなどが生じない上に、マスクの印刷用開口部内に残留する印刷物質の量が減少する分だけ厚みが大きくなる。

【0017】さらに、上記発明において、印刷ヘッドが通過した後にマスク上に残存する印刷物質の量を、前記印刷ヘッドの前記マスクに対する角度、前記印刷ヘッドの前記マスクに対する押圧力および前記印刷ヘッドの移動速度の少なくとも一つを制御することによって設定することができる。これにより、印刷ヘッドをマスクに対する角度が小さくなるよう配置して移動方向に向け大きく傾斜させるか、印刷ヘッドのマスクに対する圧力を若干小さく設定するか、印刷ヘッドの移動速度を僅かに遅く設定するか、の少なくとも何れかの手段を採用すれば、印刷ヘッドによるマスク上の印刷物質を掻き取る力が低下するから、印刷ヘッドが通過した後のマスク上に少量の印刷物質を残存させることができる。

【0018】一方、本発明のプリント回路基板の印刷装置は、配線パターンを形成するための被印刷基材がセットされる印刷用ステージと、配線パターンを形成するための配線用開口部を有するマスクを前記被印刷基材に対し所定の間隔で相対向する配置で支持するマスク支持体

と、前記マスク上に乗せた印刷物質を印刷方向に移動させながら前記配線用開口部を通過させて前記被印刷基材上に付着させる印刷ヘッドと、前記印刷ヘッドを上下動自在に支持するヘッド保持部材と、前記ヘッド保持部材を印刷方向に移動させるヘッド移動機構と、前記ヘッド保持部材の下限位置の調整によって前記印刷ヘッドの前記マスクに対する押圧力を制御する制御部とを備えて構成されていることを特徴としている。

【0019】このプリント回路基板の印刷装置では、マスクを被印刷基材に対し所定の間隔に支持するマスク支持体と、印刷ヘッドのマスクに対する押圧力を制御する制御部とを備えているので、本発明の印刷方法を忠実に具現化して、印刷方法の効果を確実に得ることができる。

【0020】上記発明において、マスク支持体は所定の厚みを有して印刷用ステージとマスクとの間に介在される複数の支持用スペーサからなり、前記各支持用スペーサは、前記マスクが各々の上面間に架け渡す状態で載置でき、且つ移動する印刷ヘッドの両端部を前記マスクを介し支持できる配置で前記印刷用ステージ上に設置されている構成とすることが好ましい。

【0021】これにより、印刷ヘッドの両端部分がマスクを介し複数の支持用スペーサで支持されながら移動するので、マスクの被印刷基材に対する間隔つまり配線パターンの厚みは、所望の厚みを有する支持用スペーサを選択して設置することにより設定できるから、複雑な制御回路などを必要とせず、常に所定値に確実に保持できる。

【0022】

【発明の実施の形態】以下、本発明の好ましい実施の形態について図面を参照しつつ詳細に説明する。図1は本発明の第1の実施の形態に係るプリント回路基板の印刷方法を具現化した印刷工程を模式的に示した概略断面図であり、同図において、図7と同一若しくは同等のものには同一の符号を付して、重複する説明を省略する。この実施の形態に係る印刷工程は図7の印刷工程と同一の構成を用いて行うが、図7の印刷工程と相違するのは、スクリーンマスク3を被印刷基材1に対し任意に設定した間隔dだけ離間させ、且つ印刷ヘッド8の移動の際にも上記間隔dを常に保持しながら印刷用ペースト7をスクリーンマスク3上に付着させて配線パターンを形成する点のみである。

【0023】図2は上記印刷工程における印刷動作中の状態を模式的に示した概略断面図であり、印刷ヘッド8の移動によって印刷用ペースト7をスクリーンマスク3に塗り付けることにより、スクリーンマスク3の配線パターンを形成するための配線用開口部3aを通過した印刷用ペースト7が被印刷基材1に付着して、被印刷基材1に印刷用ペースト7による配線パターン10が印刷形成される。このとき、印刷ヘッド8はスクリーンマスク

3を撓ませない圧力に設定されており、スクリーンマスク3は、印刷ヘッド8の移動による印刷動作時に被印刷基材1に対し常に設定された間隔dを維持する相対位置を保持し続ける。

【0024】したがって、被印刷基材1上に印刷形成される配線パターン10の厚みは、スクリーンマスク3の厚みとは無関係に、被印刷基材1とスクリーンマスク3との間隔dにほぼ一致する。例えば、スクリーンマスク3の厚みが0.1 mmであって、被印刷基材1とスクリーンマスク3との間隔dが0.5 mmである場合には、配線パターン10が0.5 mmの厚みに形成され、この厚みは、従来の印刷工程により形成される配線パターン9の厚み（スクリーンマスク3の厚みに一致した約0.1 mm）に比較して約5倍となる。

【0025】また、配線パターン10の厚みは、スクリーンマスク3を被印刷基材1に対し任意の間隔dに可変して固定することと、印刷ヘッド8のスクリーンマスク3に対する圧力を制御することとにより、任意に可変設定することができる。さらに、配線パターン10の厚みはスクリーンマスク3の厚みとは無関係に設定できるので、スクリーンマスク3の厚みは可及的に薄くすることができる。それにより、上記印刷工程では、微細な配線パターンや微小な接続用ランドであっても、所要の厚みを有し、且つ欠けなどの無い所定形状に確実に印刷形成することが可能となる。

【0026】しかも、上記印刷工程では、配線パターン10の微細化を図る場合、それに伴って配線の幅が小さくなる分だけ配線の厚みを大きく設定することができるから、所要の電流容量を有する微細な配線パターン10を得ることができる。また、上記印刷工程では、スクリーンマスク3の厚みに関係なく配線パターン10の厚みを任意に設定できることから、厚みの小さい単一のスクリーンマスク3を用いた1回の印刷工程を行うことにより、微細な配線パターンと大型電子部品用および小型電子部品用の各接続ランドを同時に印刷形成できるので、製造コストの増大を招くことがない。

【0027】図3は、本発明の第2の実施の形態に係るプリント回路基板の印刷方法を具現化した印刷工程を模式的に示した概略断面図であり、同図において、図1と同一若しくは同等のものには同一の符号を付して、重複する説明を省略する。この実施の形態の印刷工程は、図1の印刷工程と比較して、同一の構成を用いるとともに、スクリーンマスク3を被印刷基材1に対し任意に設定した間隔dだけ離間させ、且つこの間隔dを常に保持しながら印刷ヘッド8を移動させることによって印刷用ペースト7を被印刷基材1上に付着させて印刷を行う点において同様であるが、印刷ヘッド8がスクリーンマスク3上に印刷用ペースト7を少量残しながらスクリーンマスク3上を移動して印刷を行う点においてのみ相違する。印刷ヘッド8が通過したあとのスクリーンマスク3

上に残存する少量の残存ペースト7aは、印刷終了後にスクリーンマスク3を被印刷基材1の上方に引き上げる際に、被印刷基材1に印刷済みの印刷用ペーストつまり配線パターン10のスクリーンマスク3に対する離型性を向上させるものである。

【0028】この実施の形態の印刷工程では、第1の実施の形態の印刷工程に比較して、印刷ヘッド8を、スクリーンマスク3に対する角度が小さくなるよう配置して、図示矢印で示す移動方向に向け大きく傾斜させるとともに、スクリーンマスク3に対する圧力を若干小さく設定し、且つ移動速度を僅かに遅く設定している。これにより、印刷ヘッド8は、スクリーンマスク3上の印刷用ペースト7を掻き取る力が低下するから、残存ペースト7aを生じさせながらスクリーンマスク3上を移動できる。この残存ペースト7aの厚みは、上述の印刷ヘッド8のスクリーンマスク3に対する角度および圧力と移動速度の設定または制御によって任意に可変調整できる。

【0029】つぎに、残存ペースト7aの存在による効果について説明する。印刷終了後にスクリーンマスク3を引き上げる場合には、印刷用ペースト7のスクリーンマスク3に対する粘着力によって印刷済みの配線パターン10を変形させる力が作用するが、その配線パターン10の変形は剪断応力が集中する部分から始まる。図4は印刷終了後にスクリーンマスク3を離間させる際の印刷済みの配線パターン10に作用する剪断応力の説明図である。同図において、スクリーンマスク3を引き上げる際には、印刷済みの配線パターン10におけるスクリーンマスク3の配線用開口部3aの開口端孔壁面に接する丸印で囲った箇所は、矢印で示す方向の剪断応力が集中的に作用する。

【0030】いま仮に、この実施の形態のような残存ペースト7aを設けない場合には、配線パターン10における上記応力集中箇所にて切れが生じて、スクリーンマスク3を引き上げた後の配線パターン10の上端面に凹みが発生し、配線パターン10の厚みが上記凹み分だけ減少することになる。これに対し、残存ペースト7aを形成した場合には、上記応力集中箇所における配線パターン10の粘着力が残存ペースト7aの存在によって低下し、それに伴い応力集中箇所の配線パターン10の配線用開口部3aの開口端孔壁面に対する付着力も低下する。そのため、応力集中箇所における配線パターン10には、スクリーンマスク3を引き上げる際の剪断力が格段に低減されて切れが生じないので、印刷済みの配線パターン10は、その上端面に凹みなどが生じない上に、スクリーンマスク3の配線用開口部3a内に残留する印刷用ペースト7の量が減少する分だけ厚みが大きくなる。

【0031】実測結果によると、0.1 mmの厚みのスクリーンマスク3上に残存ペースト7aを100 μmの厚み

に形成した場合には、配線用開口部3a内に残留する印刷用ペースト7の量が、上記と同じ厚みのスクリーンマスク3を用いて従来の印刷工程を実施した場合の印刷用ペースト7の残留量の1/3に減少させることができた。換言すると、この印刷工程では、印刷ヘッド8の条件設定によって残存ペースト7aの厚みを適正值に制御することにより、印刷用ペースト7の被印刷基材1に対する印刷量を制御するときの精度を約3倍に向上させることができる。

【0032】図5は、上記実施の形態の各印刷方法を実用化するための本発明の一実施の形態に係るプリント回路基板の印刷装置の概略構成を示す切断正面図、図6はその印刷装置の概略構成を示す切断側面図であり、これらの図において、図1ないし図4と同一若しくは同等のものには同一の符号を付してある。印刷用ステージ2上には、これの被印刷基材1の両側面にそれぞれ近接する箇所、所定厚みを有するレール状の一对の支持用スペーサ11が載置されている。スクリーンマスク3は、その一对の支持用スペーサ11上に架け渡す状態に設置されて、被印刷基材1に対し所定の間隔dで相対向する高さ位置に固定されている。すなわち、支持用スペーサ11は、被印刷基材1上に形成すべき配線パターンを設定厚みに被印刷基材1の厚みを加算した厚みを有している。また、同一の一对の支持用スペーサ11は、図5に明示するように、印刷ヘッド8の両端部をスクリーンマスク3を介し支持できる間隔に配置されている。

【0033】つぎに、印刷ヘッド8を水平方向に直線移動および上下動させる機構について説明する。サーボモータ12により回転駆動されるボールねじ13にはナット部材14が螺合されており、上記ボールねじ13に平行に配置されたガイドシャフト18には、ナット部材14に一体に設けられた取付部材17がこれのガイド孔17aにガイドシャフト18を挿通させて摺動自在に取り付いている。これにより、取付部材17は、ボールねじ13が回転したときにガイドシャフト18に沿って移動するようになっている。この取付部材17にはエアシリンダ19が吊り下げ状態に固着されており、そのエアシリンダ19のピストンロッド19aの先端部には、印刷ヘッド8がねじ20により取り付けられている。また、サーボモータ12およびエアシリンダ19はコントローラ21により駆動制御される。

【0034】つぎに、上記印刷装置の作用について説明する。まず、印刷用ステージ2上の所定位置には被印刷基材1がセットされ、その被印刷基材1の両側端に近接する箇所には一对の支持用スペーサ11が互いに平行な配置で設置される。一方、スクリーンマスク3は、印刷位置において所定の高さ位置に保持された状態において、その上面に印刷用ペースト7が供給される。続いて、印刷用ステージ2が移動してこれにセットされている被印刷基材1をスクリーンマスク3に対しこれの下方

で相対向するよう位置決めする。そのうち、スクリーンマスク3は、下降されて一对の支持用スペーサ11上に架け渡す状態に載置され、被印刷基材1に対し支持用スペーサ11の厚みで設定された所定の間隔dに位置決めされる。

【0035】つぎに、コントローラ21は、エアシリンダ19を吸引作動するよう制御して、印刷ヘッド8をスクリーンマスク3に接触しない高さ位置まで引き上げさせる。続いて、コントローラ21は、サーボモータ12を逆方向に向け回転するよう制御して取付部材17をガイドシャフト18に沿いながら移動させて、印刷ヘッド8をスクリーンマスク3の印刷初期位置に対向するよう位置決めし、そののちに、エアシリンダ19に対し予め設定されたストロークだけ吐出するよう作動制御する。これにより、エアシリンダ19のピストンロッド19aの先端に固着されている印刷ヘッド8は、スクリーンマスク3に対し予め設定された印圧で押し付けられる。つぎに、コントローラ21は、エアシリンダ19を上記吐出状態に保持したまま、サーボモータ12を正方向に向け回転するよう制御して、印刷ヘッド8を印刷方向に移動させていく。これにより、被印刷基材1上には、スクリーンマスク3の配線用開口部を通して付着した印刷用ペースト7により、所定形状の配線パターンが印刷形成される。

【0036】上記印刷工程では、印刷ヘッド8の両端部分がスクリーンマスク3を介し一对の支持用スペーサ11で支持されながら移動するので、スクリーンマスク3の被印刷基材1に対する間隔dつまり配線パターンの厚みは、所望の厚みを有する支持用スペーサ11を選択して設置することにより設定できるから、複雑な制御回路などを必要とせず、常に所定値に確実に保持できる。また、印刷ヘッド8のスクリーンマスク3に対する印圧は、コントローラ21がエアシリンダ19の吐出ストロークを制御することによって適正值に制御され、それにより、印刷ヘッド8は常に所定の高さ位置を保持しながら掃引されていく。さらに、印刷ヘッド8のスクリーンマスク3に対する角度は、ねじ20を緩めたのちに可変調整して、再びねじ20を締め付けることによって任意の値に設定して固定できる。したがって、この印刷装置は、上述した第1および第2の何れの実施の形態の印刷方法をも忠実に具現化して実用化することができるものである。

【0037】

【発明の効果】以上のように本発明のプリント回路基板の印刷方法によれば、マスクを被印刷基材に接触させずに印刷物質を被印刷基材に付着させるので、被印刷基材上に印刷形成される配線パターンの厚みが、マスクの厚みとは無関係に、被印刷基材とマスクとの間隔にほぼ一致する。したがって、配線パターンの厚みは、マスクを被印刷基材に対し任意の間隔に可変することによって任

意の値に設定することができる。さらに、配線パターン
の厚みはマスクの厚みとは無関係に設定できるので、マ
スクの厚みは可及的に薄くすることができる。これによ
り、この印刷方法では、微細な配線パターンや微小な接
続用ランドであっても、所要の厚みを有し、且つ欠けな
どの無い所定形状に確実に印刷形成することが可能とな
る。しかも、配線パターンは同一のマスクを用いた1回
の印刷工程で形成できるので、製造コストの増大を招か
ない。

【0038】また、本発明のプリント回路基板の印刷装
置によれば、マスクを被印刷基材に対し所定の間隔に支
持するマスク支持体と、印刷ヘッドのマスクに対する押
圧力を制御する制御部とを備えた構成としたので、本発
明の印刷方法を忠実に具現化して、印刷方法と同様の効
果を確実に得ることができる。

【図面の簡単な説明】

【図1】本発明の第1の実施の形態に係るプリント回路
基板の印刷方法を具現化した印刷工程を模式的に示した
概略断面図。

【図2】同上の実施の形態における印刷動作中の状態を
模式的に示した概略断面図。

【図3】本発明の第2の実施の形態に係るプリント回路
基板の印刷方法を具現化した印刷工程を模式的に示した

概略断面図。

【図4】同上の実施の形態における印刷動作終了後にス
クリーンマスクを引き上げる際の印刷済み配線パターン
に作用する剪断応力の説明図。

【図5】本発明の一実施の形態に係るプリント回路基板
の印刷装置の概略構成を示す切断正面図。

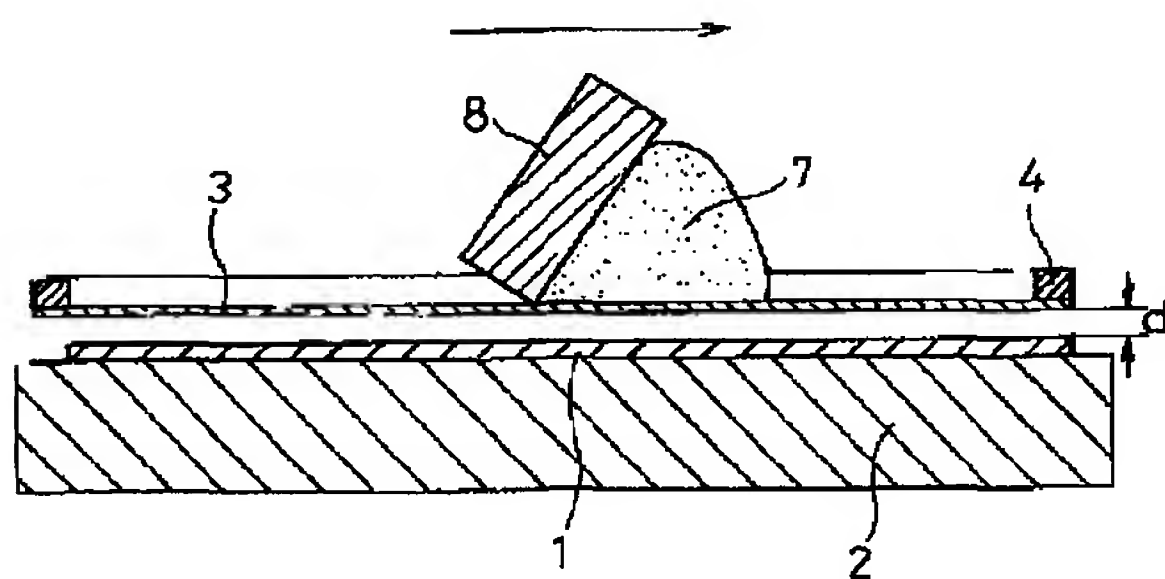
【図6】同上の印刷装置の概略構成を示す切断側面図。

【図7】従来のプリント回路基板における印刷工程を模
式的に示した断面図。

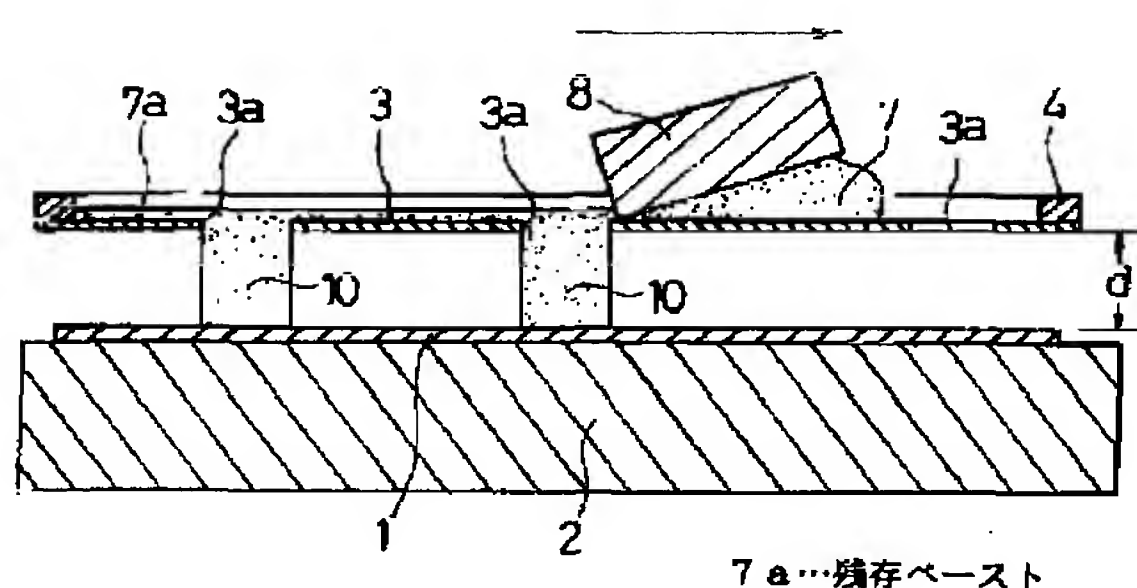
【符号の説明】

- 1 被印刷基材
- 2 印刷用ステージ
- 3 スクリーンマスク（マスク）
- 3a 配線用開口部
- 7 印刷用ペースト（印刷物質）
- 7a 残存ペースト
- 8 印刷ヘッド
- 10 配線パターン
- 11 支持用スペーサ（マスク支持体）
- 15 ヘッド移動機構
- 19 エアシリンダ（ヘッド保持部材）
- 21 コントローラ（制御部）

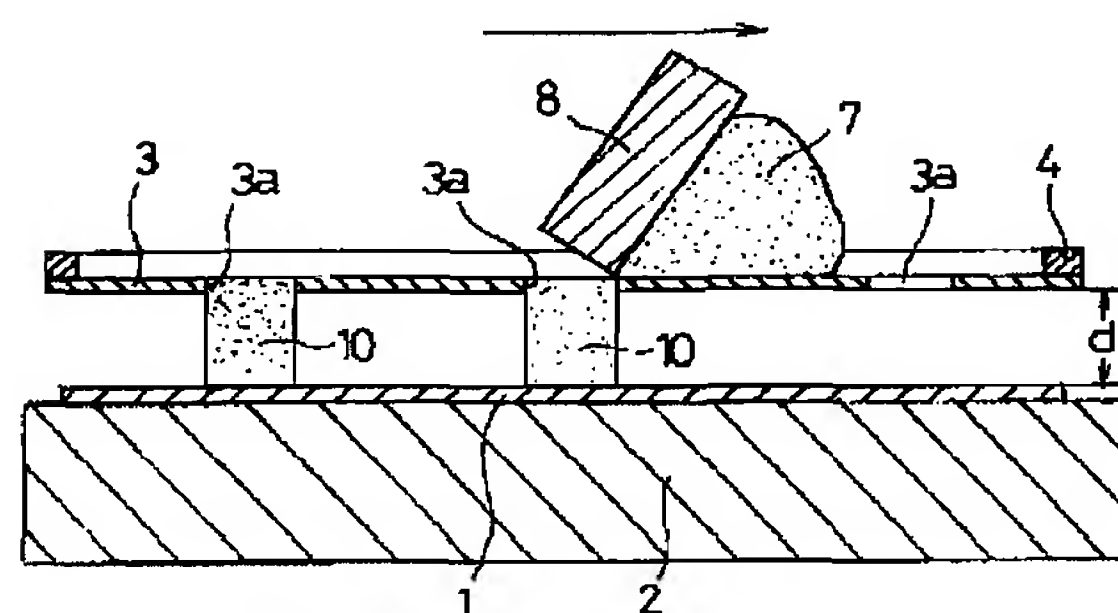
【図1】



【図3】

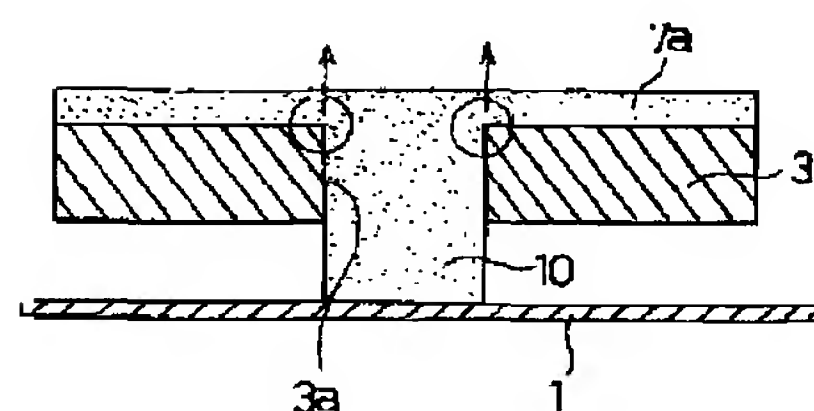


【図2】

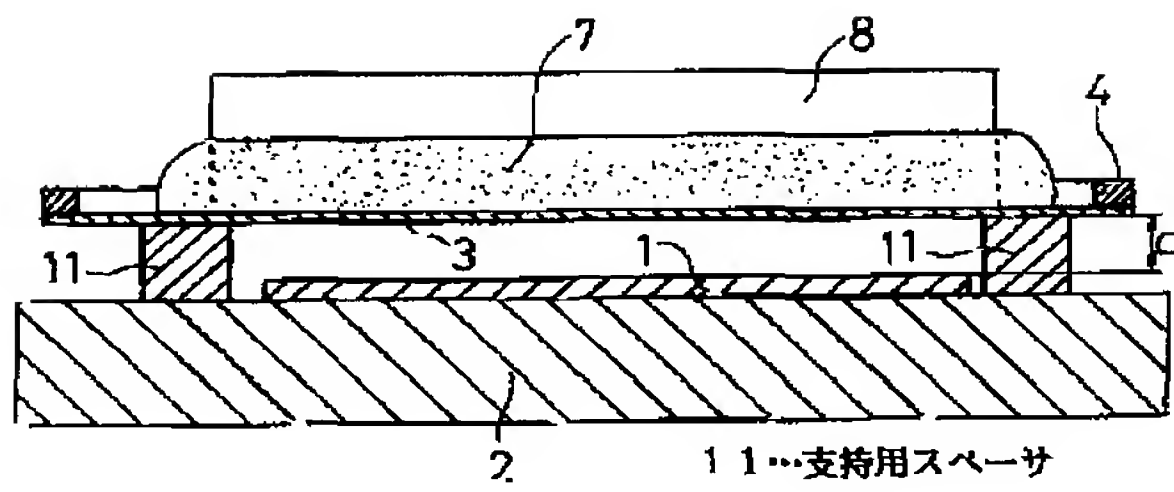


- 1...被印刷基材
- 2...印刷用ステージ
- 3...スクリーンマスク (マスク)
- 3a...配線用開口部
- 7...印刷用ペースト (印刷物質)
- 8...印刷ヘッド
- 10...配線パターン

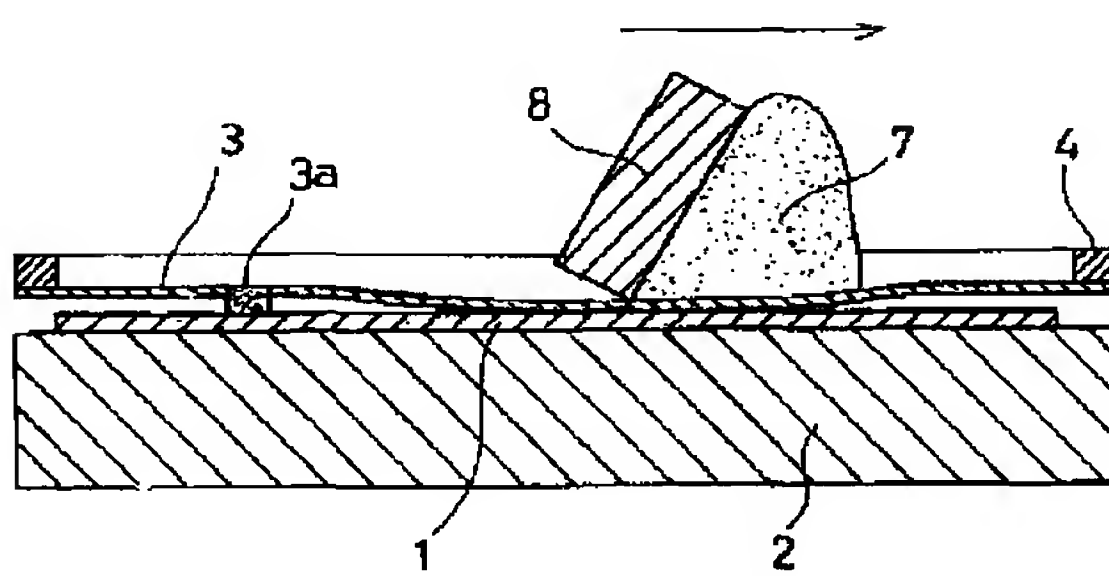
【図4】



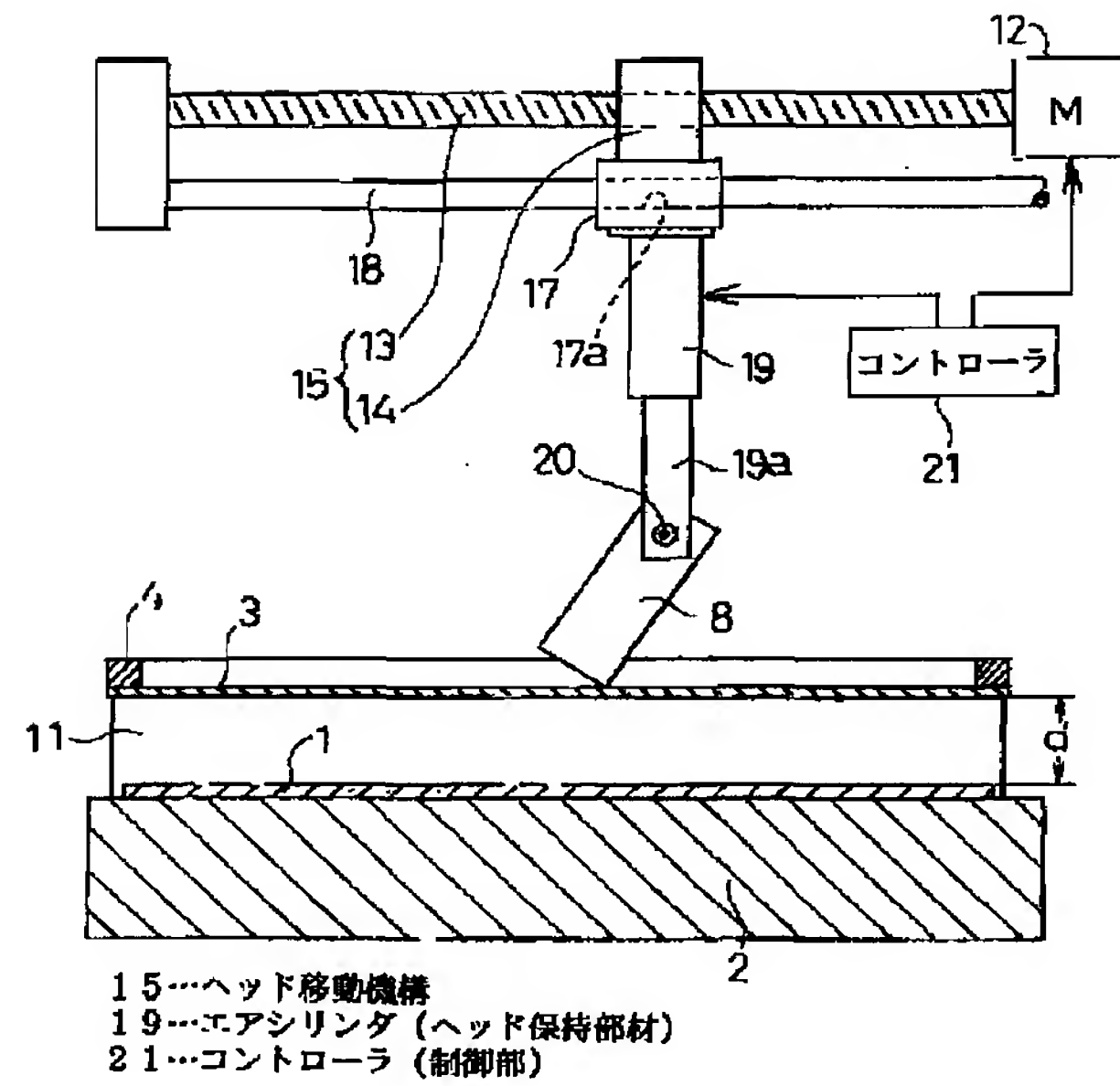
【図5】



【図7】



【図6】



フロントページの続き

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